UNION TOOL

Tungsten Carbide End Mills
UNIMAX Series Vol.1
MOULD & DIE APPLICATIONS

UNION TOOL EUROPE S.A.

Union Tool Presentations

Union Tool CO. is a global based leader in Dental technology that consistently delivers exceptional results. We work with respected Dental professionals to advance meaningful innovation, improve productivity and performance and supplying quality products time and time again. Our goal is to be the Provider and Partner of choice.

Union Tool CO. is known for its world-class products and a leadership team that sets a company standard of excellence.

Union Tool Europe S.A. is a wholly owned subsidiary of Union Tool CO. in Japan. The European office was founded in 1986 in Neuchâtel in Switzerland in the heart of the Swiss watch making industry.

Union Tool Europe S.A. has pan-European distribution network who are committed to offering the best service and support. The objectives of our supply chain partners are:

- To be close to our customers in order to fully understand their needs and requirements.
- To support our customers in improving their productivity by supplying Union Tools state of the art products.
- To offer world-class logistics and technical support.

Our relationship to our customers:

We foster long-term partnerships with our customers based on openness, honesty and trust. We focus on the needs and wishes of our customers. Our focus is on intense research into new materials, improved coatings and future-oriented technologies. We will perform customer specific tool developments in our technical centre in Japan and then carry out the qualification trials onsite with the customer.

Japanese Precision and Innovation:

At Union Tool CO., everything is “Made in Japan” - starting from research and development all the way to the design and production of our own unique manufacturing machines which are used to manufacture our products. This guarantees the renowned Japanese quality and precision. Quality controls in all phases of the manufacturing process ensure compliance with the strict requirements and guarantee that only products of flawless quality are delivered to our customers.

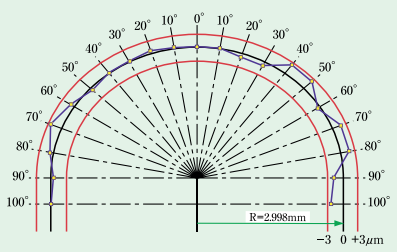
Values that inspire:

- Union Tool design & Japanese precision
- Leadership & Excellence & Innovation
- Worldwide Experience
- ISO 9001 / 14001 certified

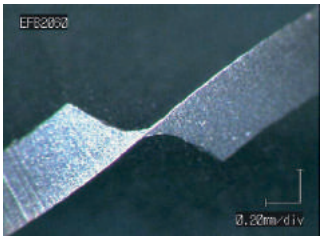
Precision that speaks for itself:

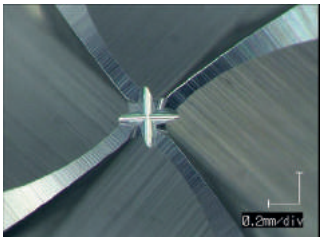
At Union Tool “precision” is in our DNA and is present in everything that we do. We offer standard tools with +/-3 micron radius tolerances. We also offer this precision and quality time and time again and batch after batch.

Measurements of Ball R Accuracy
Model : High R Tolerance Ball End Mill
Lot. No.:7720011
No.001



Angle	L side	R side
0°	2.998	2.998
10°	2.998	2.998
20°	2.999	2.997
30°	2.998	2.997
40°	2.998	3.000
50°	2.997	3.000
60°	2.999	2.997
70°	3.000	3.000
80°	2.999	3.000
90°	2.997	2.997
100°	2.998	2.996
R Accuracy	R=2.998	+0.002 −0.002
Actual Outer Diameter	φD=5.996	





Exceeding your expectations.

Icon Definitions

unit : mm

Tool Material

Super MG — Super Micro Grain

MG — Micro Grain

cBN — cBN

Coating

HARD MAX — HARDMAX

MICRO COAT — UT MICRO COAT

UT COAT — UTCOAT

Helix Angle

20° — Helix Angle 20°

24° — Helix Angle 24°

25° — Helix Angle 25°

30° — Helix Angle 30°

37°~40° — Helix Angle 37°~40°

40° — Helix Angle 40°

45° — Helix Angle 45°

0° — Helix Angle 0°

20° — Helix Angle 20°

30° — Helix Angle 30°

35° — Helix Angle 35°

40° — Helix Angle 40°

Geometry

R — Corner Radius Design

Sharp Corner — Sharp Corner Design

Flatland — Flatland Design

Variable Lead — Variable Lead

Back Taper — Back Taper Geometry

Variable — Variable Pitch

X — X Thinning Design

Shank Diameter Tolerance

Shank Dia 0/-0.005 — Tolerance of Shank Diameter : 0/-0.005

Ball Radius Tolerance

R ±0.002 — Ball Radius Tolerance : ±0.002

R ±0.003 — Ball Radius Tolerance : ±0.003

R ±0.005 — Ball Radius Tolerance : ±0.005

R ±0.007 — Ball Radius Tolerance : ±0.007

R ±0.01 — Ball Radius Tolerance : ±0.01

Corner Radius Tolerance

R ±0.003 — Corner Radius Tolerance : ±0.003

R ±0.005 — Corner Radius Tolerance : ±0.005

R ±0.01 — Corner Radius Tolerance : ±0.01

R ±0.015 — Corner Radius Tolerance : ±0.015

R ±0.02 — Corner Radius Tolerance : ±0.02

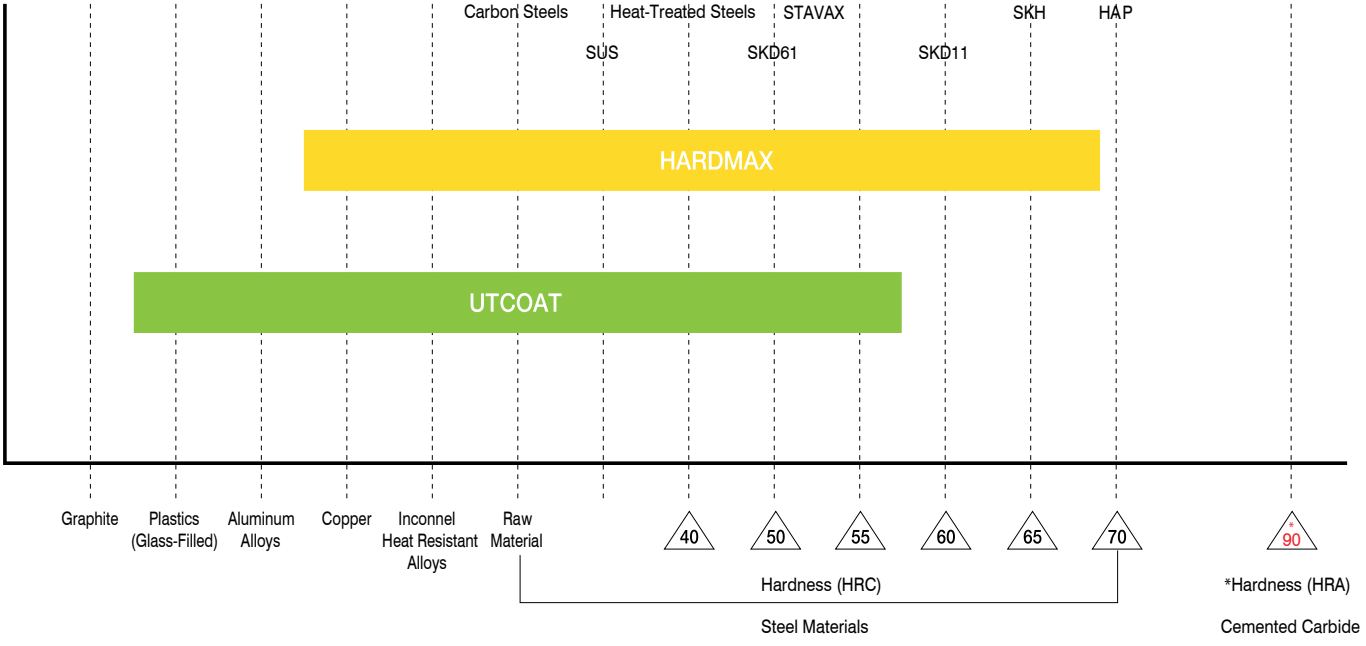
Coating Features

☆Highly Recommended ◎Recommended ○Suggested △Satisfactory

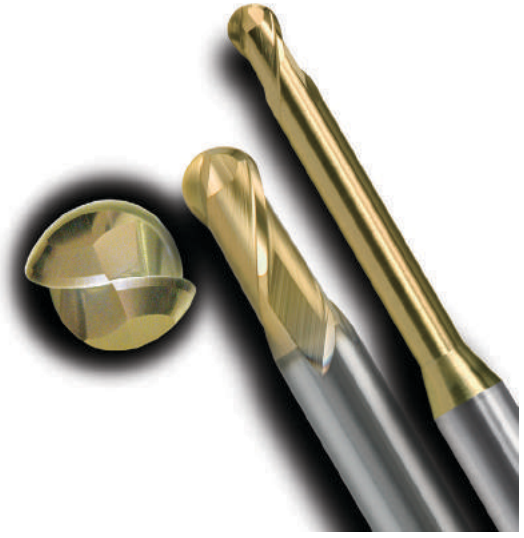
Type	Colour	Hardness (HV)	Heat Resistance	Toughness	Lubricant Efficiency	Recommended Use
HARD MAX	Yellow～Gold	3500～4000	☆	○	◎	for Steels
UT COAT	Purple～Black	3000～3500	◎	◎	☆	

How to find best coating for your material applications

We recommended either DRY or WET coolant for UTCOAT and HARDMAX.



Coating Features



Hardmax coating was designed mainly for the «Direct Milling » applications. This coating is the perfect choice for milling hardened steel up to 70 HRC.

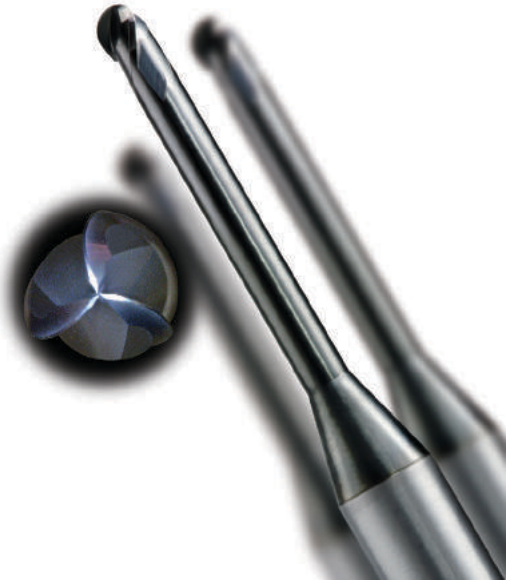
Coating Features: This multilayer coating is designed to offer one of the best heat resistance when milling.
With this coating you can rough and finish a part directly with the raw material already hardened.

We mainly recommend oil or oil mist as the coolant.

This coating has an amazing heat resistance and a good lubricant efficiency which increases the tool life.

Main application: Mould & Die.

Main Material : D2 (60 - 62 HRC), SK11 (60 - 63 HRC), DRM2 (60 - 65HRC) and many other hardened steel or stainless steel references.



UT Coat coating was designed for general application in steels, carbon steels, stainless steels, titanium, heat resistant alloys such as inconnel material, copper, aluminium and many other «soft» materials.

Coating Features: This multilayer coating is designed for an incredible lubricant effiency with good heat resistance.
With this versatile coating you can mill many different materials and adapt the conditions to the material and your requirements.

We mainly recommend water soluble, oil as the coolant.
You can apply also air coolant or oil mist.

This coating has an incredible lubricant effieciency with a good heat resistance which helps to evacuate the swarf and avoid tool breakage.

Main Application: Part Milling, Medical, Plastic Mould.

Main Material: Titanium grade 5, stavax, ramax, inconel 718 and many others.

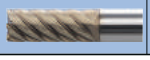
Index

Alphabetical Order

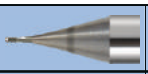
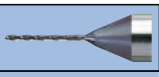
Index

Alphabetical Order

Tool Type

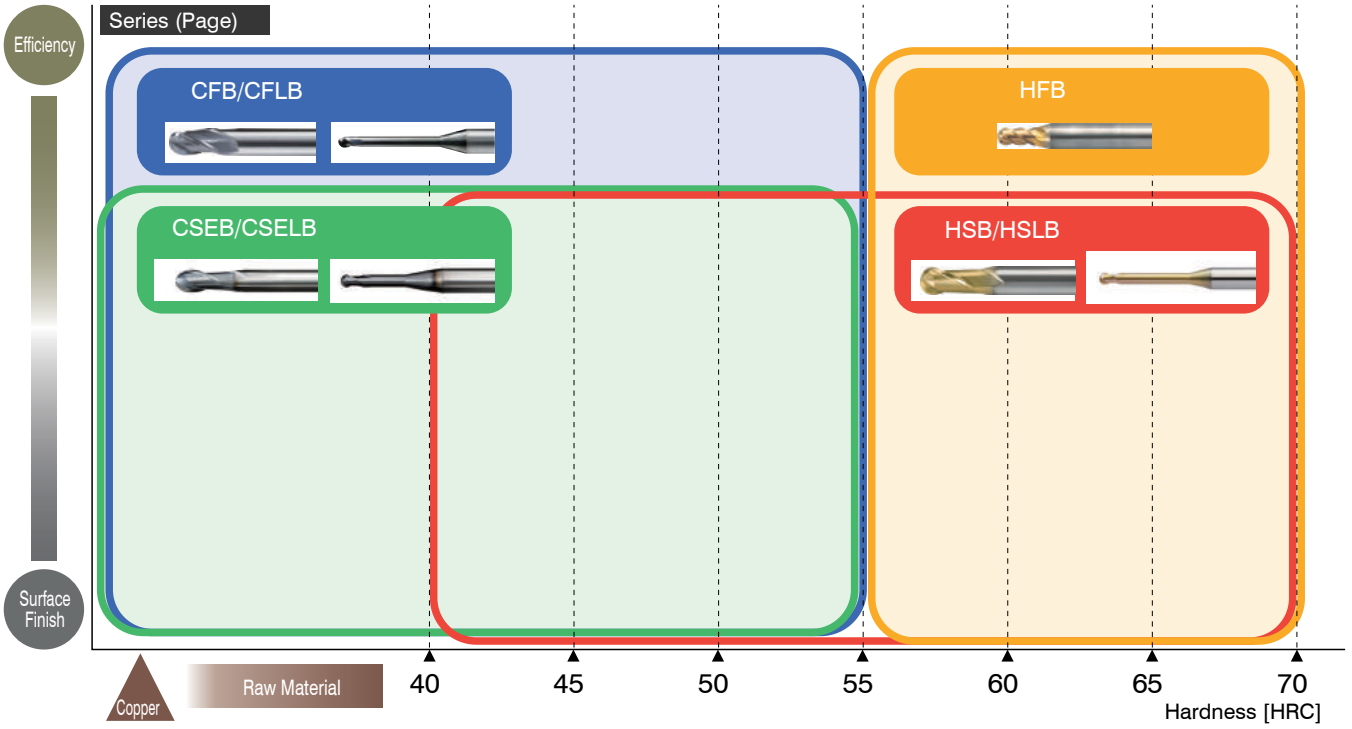
Model Number	Appearance	Size	Number of Flutes	Pages	Process			Work Material		
					Roughing	Semi-Finishing	Finishing	Soft State < 300Hb Steel & Stainless Steel	Hardened Steel & SS < 55 - 58 HRC	Hardened Steel & SS < 65 - 70 HRC
Square Type										
CESUS		Ø6 - Ø12	4	12	■	■	□	●	●	
CXES		Ø1 - Ø16	4	16	■	■	□	●	●	
CZS		Ø1 - Ø20	4	24	■	■	□	●	●	
HMES SP		Ø1 - Ø12	4	36	■	■	■	●	●	
HMS		Ø1 - Ø12	3 - 6	38	■	■	■	●	●	●
Long Neck Square										
CXS		Ø1 - Ø12	4	42	■	■	□	●	●	
HLS 2000		Ø0.1 - Ø6	2	50	□	■	■	•	●	●
HLS 4000		Ø1 - Ø6	4	64	□	■	■	•	●	●
Corner Radius										
CNRS		Ø0.5 - Ø1	2	70		□	■			●
CXERS		Ø2 - Ø12	4	74	■	■	□	●	●	
CXRS		Ø3 - Ø12	4	80	■	■	□	●	●	
HMERS		Ø3 - Ø12	4 - 6	84	■	■	■	●	●	●
Long Neck Corner Radius										
CBN-LR		Ø0.5 - Ø1	2	88		□	■			●
CRRS		Ø2 - Ø12	4	90	■	■	□	●	●	
CXLRS		Ø3 - Ø12	5	96	■	■	□	●	●	
HHRS		Ø6 - Ø12	6	100	□	■	■		●	●
HLRS 2000/2000E		Ø0.2 - Ø6	2	102	□	■	■	•	●	●
HLRS 4000		Ø0.8 - Ø6	4	122	□	■	■	•	●	●
HRRS		Ø2 - Ø12	4	138	■	■	□		●	●
HRRS-S		Ø2 - Ø12	4	144	■	■	□		●	●

Tool Type

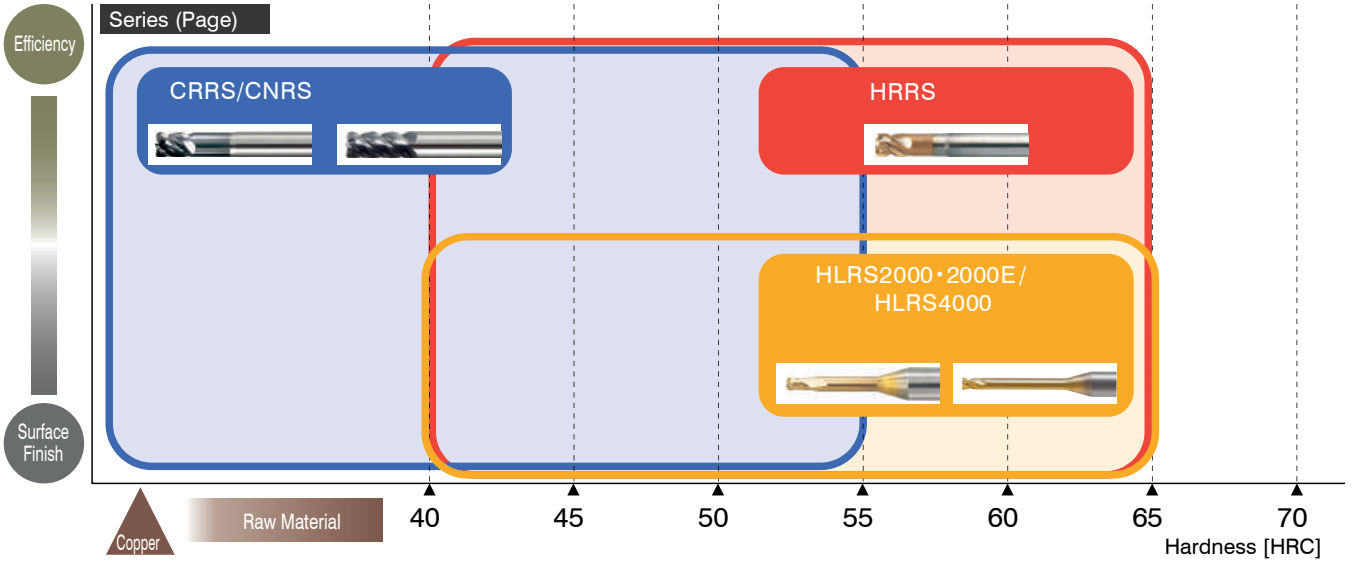
Model Number	Appearance	Size	Number of Flutes	Pages	Process			Work Material		
					Roughing	Semi-Finishing	Finishing	Soft State < 300Hb Steel & Stainless Steel	Hardened Steel & SS < 55 - 58 HRC	Hardened Steel & SS < 65 - 70 HRC
Taper Corner Radius										
HTNRS		Ø1 - Ø6	4	146	▢	■	■		●	●
Ball Nose										
CFB		R0.3 - R6	3	152	■	■	■	●	●	
CSEB		R0.05 - R6	2	158	▢	■	■	●	●	
HFB		R1 - R6	4	164	■	■	■		●	●
HFB-S		R1 - R6	4	165	■	■	■		●	●
HGB		R0.5 - R3	2	170	■	■	■		●	●
HSB		R0.05 - R6	2	172	▢	■	■		●	●
HSB-S		R0.1 - R2	2	176	▢	■	■		●	●
Long Neck Ball Nose										
CBN-LBF		R0.1 - R0.5	2	178		▢	■			●
CFLB		R0.3 - Ø6	3	188	■	■	■	●	●	
CSELB		R0.05 - R3	2	194	▢	■	■	●	●	
HGLB		R0.5 - R1	2	208	■	■	■		●	●
HSLB		R0.05 - R3	2	210	▢	■	■		●	●
HSLB-S		R0.1 - R3	2	226	▢	■	■		●	●
Taper Ball Nose										
HTNB		R0.1 - R2	2	230	▢	■	■		●	●
HFTNB		R0.5 - R2	3	244	▢	■	■		●	●
Drill										
C-UMD		Ø0.1 - Ø3	2	250				●	●	•
UTDF		Ø2 - Ø12	2	256				●		
UTDLX		Ø0.3 - Ø2	2	262				●	●	•
UTDSX		Ø0.3 - Ø2	2	268				●	●	•

Tool Chart

Ball

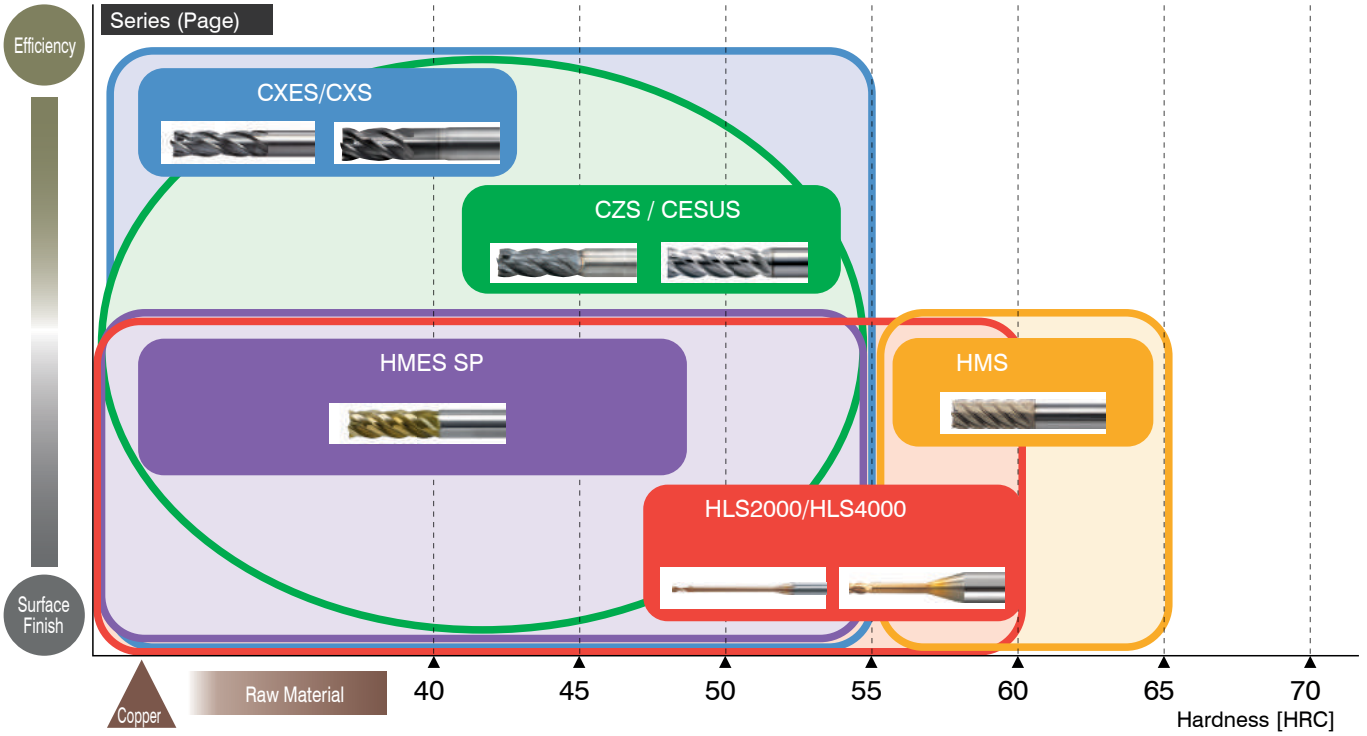


Radius



Tool Chart

Square



For Stavax		
Ball	CSEB / CSELB	Page 158/194
	CFB / CFLB	Page 152/188
	HFB	Page 164
Radius	CNRS	Page 70
	CRRS	Page 90
	CXRS / CXLRS	Page 80/96
Square	CZS	Page 24
	CXS	Page 42
	HMS	Page 38

For Titanium		
Ball	CSEB / CSELB	Page 158/194
	CFB / CFLB	Page 152/188
	HFB	Page 164
Radius	CNRS	Page 70
	CRRS	Page 90
	CXRS / CXLRS	Page 80/96
Square	CZS	Page 24
	CXS	Page 42
	HMS	Page 38

For Stainless Steel		
Ball	CSEB / CSELB	Page 158/194
	CFB / CFLB	Page 152/188
	HFB	Page 164
Radius	CXRS / CXLRS	Page 80/96
	CRRS	Page 90
	CNRS	Page 70
Square	CXS	Page 42
	CZS	Page 24
	CESUS	Page 12

For Hardened Steel > 55 - 60 HRC		
Ball	HSB / HSLB	Page 172/210
	HFB	Page 164
	CBN-LBF	Page 178
Radius	HLRS 2000 / 4000	Page 102/122
	HRRS	Page 138
	HHRS	Page 100
Square	HMS	Page 38
	HLS 2000/4000	Page 50/64
	HMES SP	Page 36

For Heat Resistant Steels		
Ball	CSEB / CSELB	Page 158/194
	CFB / CFLB	Page 152/188
	HFB	Page 164
Radius	CNRS	Page 70
	CRRS	Page 90
	CXRS / CXLRS	Page 80/96
Square	CZS	Page 24
	CXS	Page 42
	HMS	Page 38

For Hardened Steel < 55 HRC		
Ball	CSEB / CSELB	Page 158/194
	CFB / CFLB	Page 152/188
	HFB	Page 164
Radius	CXRS / CXLRS	Page 80/96
	CRRS	Page 90
	CNRS	Page 70
Square	HMS	Page 38
	CZS	Page 24
	HMES SP	Page 36

4 Flutes UTSCOAT for Stainless Steels

Size Ø6~Ø12

CESUS

NEW

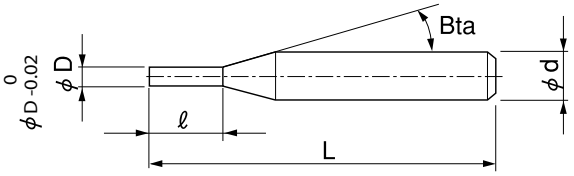
Super MG | UTS COAT | 40°~42° | Flatland | Shank Dia 0/-0.005 | Variable Pitch | Variable Helix

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	☆	○				○			○			○	○		

Features

4 Flute Highly Efficient Square End Mills for stainless steels.
Variable pitch & variable helix designed for milling stainless steels offers higher efficiency milling.
New coating 'UTSCOAT' with excellent adhesion offers high resistance to breakage.

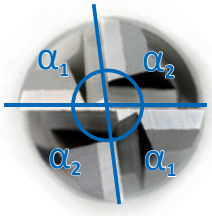


The shank taper angle shown is not an exact value and to avoid contact with the workpiece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Design features

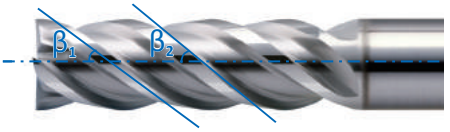
Variable pitch & variable helix designed for milling stainless steels.

Variable pitch



$\alpha_1 \neq \alpha_2$

Variable helix



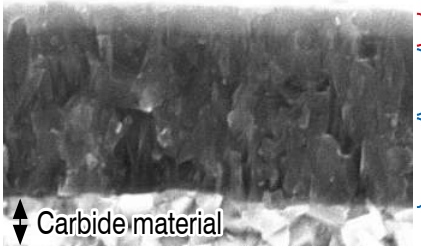
$\beta_1 \neq \beta_2$

Minimizes chattering

Stable milling under highly efficient conditions

Features of UTSCOAT

Improve the resistance to adhesion by adding a highly lubricant layer onto the high hardness and high toughness UTCOAT.



★ Ultra lubricant layer
◆ Ultra hard layer
◆ High toughness and adhesion layer

Reduce adhesion

High resistance to breakage with high lubricity

Total 21 models

Unit（mm）

Model Number	Outside Diameter ØD	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
CESUS 4060-0900	6	9	—	60	6
CESUS 4060-1300		13		60	6
CESUS 4060-1800		18		60	6
CESUS 4070-1050	7	10,5	16°	70	8
CESUS 4070-1600		16		70	8
CESUS 4070-2100		21		70	8
CESUS 4080-1200	8	12	—	70	8
CESUS 4080-1900		19		70	8
CESUS 4080-2400		24		70	8
CESUS 4090-1350	9	13,5	16°	80	10
CESUS 4090-1900		19		80	10
CESUS 4090-2700		27		80	10
CESUS 4100-1500	10	15	—	80	10
CESUS 4100-2200		22		80	10
CESUS 4100-3000		30		80	10
CESUS 4110-1650	11	16,5	16°	100	12
CESUS 4110-2200		22		100	12
CESUS 4110-3300		33		100	12
CESUS 4120-1800	12	18	—	100	12
CESUS 4120-2600		26		100	12
CESUS 4120-3600		36		100	12

Milling Conditions for CESUS

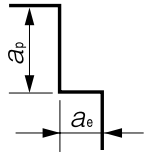
Side Milling

WORK MATERIAL			CARBON STEELS S45C/S50C Annealed Materials (~225HB)				ALLOY STEELS SK/SCM Annealed Materials (225~325HB)				STAINLESS STEELS SUS304 Use cutting oils			
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4060-0900	**6**	9	6,000	1,600	9.0	1.2	6,000	1,100	9.0	1.2	6,000	1,100	9.0	1.2
4060-1300		13	6,000	1,600	13.0	1.2	6,000	1,100	13.0	1.2	6,000	1,100	13.0	1.2
4060-1800		18	6,000	1,170	18.0	1.2	4,800	800	18.0	1.2	4,800	800	18.0	1.2
4070-1050	**7**	10.5	5,000	1,450	10.5	1.4	5,000	1,025	10.5	1.4	5,000	1,025	10.5	1.4
4070-1600		16	5,000	1,450	16.0	1.4	5,000	1,025	16.0	1.4	5,000	1,025	16.0	1.4
4070-2100		21	5,000	1,060	21.0	1.4	4,000	750	21.0	1.4	4,000	750	21.0	1.4
4080-1200	**8**	12	4,300	1,300	12.0	1.6	4,300	950	12.0	1.6	4,300	950	12.0	1.6
4080-1900		19	4,300	1,300	19.0	1.6	4,300	950	19.0	1.6	4,300	950	19.0	1.6
4080-2400		24	4,300	950	24.0	1.6	3,440	695	24.0	1.6	3,440	695	24.0	1.6
4090-1350	**9**	13.5	3,700	1,150	13.5	1.8	3,700	875	13.5	1.8	3,700	875	13.5	1.8
4090-1900		19	3,700	1,150	19.0	1.8	3,700	875	19.0	1.8	3,700	875	19.0	1.8
4090-2700		27	3,700	840	27.0	1.8	2,960	640	27.0	1.8	2,960	640	27.0	1.8
4100-1500	**10**	15	3,200	1,000	15.0	2.0	3,200	800	15.0	2.0	3,200	800	15.0	2.0
4100-2200		22	3,200	1,000	22.0	2.0	3,200	800	22.0	2.0	3,200	800	22.0	2.0
4100-3000		30	3,200	730	30.0	2.0	2,650	580	30.0	2.0	2,650	580	30.0	2.0
4110-1650	**11**	16.5	2,900	900	16.5	2.2	2,900	725	16.5	2.2	2,900	725	16.5	2.2
4110-2200		22	2,900	900	22.0	2.2	2,900	725	22.0	2.2	2,900	725	22.0	2.2
4110-3300		33	2,900	650	33.0	2.2	2,400	530	33.0	2.2	2,400	530	33.0	2.2
4120-1800	**12**	18	2,650	800	18.0	2.4	2,650	650	18.0	2.4	2,650	650	18.0	2.4
4120-2600		26	2,650	800	26.0	2.4	2,650	650	26.0	2.4	2,650	650	26.0	2.4
4120-3600		36	2,650	580	36.0	2.4	2,200	475	36.0	2.4	2,200	475	36.0	2.4
Milling Amount (mm)			a_p:All Flute a_e:0.2D				a_p:All Flute a_e:0.2D				a_p:All Flute a_e:0.2D			

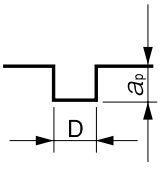
Slotting

WORK MATERIAL			CARBON STEELS S45C/S50C Annealed Materials (~225HB)			ALLOY STEELS SK/SCM Annealed Materials (225~325HB)			STAINLESS STEELS SUS304 Use cutting oils		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)
4060-0900	**6**	9	6,000	700	6.0	6,000	700	6.0	6,000	700	6.0
4060-1300		13	6,000	700	6.0	6,000	700	6.0	6,000	700	6.0
4060-1800		18	6,000	560	6.0	4,200	350	6.0	4,200	350	6.0
4070-1050	**7**	10.5	5,000	625	7.0	5,000	625	7.0	5,000	625	7.0
4070-1600		16	5,000	625	7.0	5,000	625	7.0	5,000	625	7.0
4070-2100		21	5,000	500	7.0	3,500	300	7.0	3,500	300	7.0
4080-1200	**8**	12	4,300	550	8.0	4,300	550	8.0	4,000	500	8.0
4080-1900		19	4,300	550	8.0	4,300	550	8.0	4,000	500	8.0
4080-2400		24	4,300	440	8.0	3,000	275	8.0	3,000	275	8.0
4090-1350	**9**	13.5	3,500	475	9.0	3,500	475	9.0	3,150	430	9.0
4090-1900		19	3,500	475	9.0	3,500	475	9.0	3,150	430	9.0
4090-2700		27	3,500	380	9.0	2,450	240	9.0	2,450	240	9.0
4100-1500	**10**	15	2,900	400	10.0	2,900	400	10.0	2,900	400	10.0
4100-2200		22	2,900	400	10.0	2,900	400	10.0	2,900	400	10.0
4100-3000		30	2,900	320	10.0	2,000	200	10.0	2,000	200	10.0
4110-1650	**11**	16.5	2,650	340	11.0	2,650	340	11.0	2,380	300	11.0
4110-2200		22	2,650	340	11.0	2,650	340	11.0	2,380	300	11.0
4110-3300		33	2,650	270	11.0	1,820	170	11.0	1,820	170	11.0
4120-1800	**12**	18	2,420	300	12.0	2,420	300	12.0	2,420	300	12.0
4120-2600		26	2,420	300	12.0	2,420	300	12.0	2,420	300	12.0
4120-3600		36	2,420	240	12.0	1,650	150	12.0	1,650	150	12.0
Milling Amount (mm)			a_p:1D			a_p:1D			a_p:1D		

Note:
- Decrease both spindle speed and feed rate proportionally in case of chattering.
- These milling parameters are calculated based on the shortest overhang length. Longer overhangs may require an adjustment to the milling parameters.
- Reduce the milling amount and feed rate in accordance with required milling precision.
- Every coolant offers stable milling.
- Recommend water soluble or oil coolant for Stainless Steels and Copper.



Side Milling
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

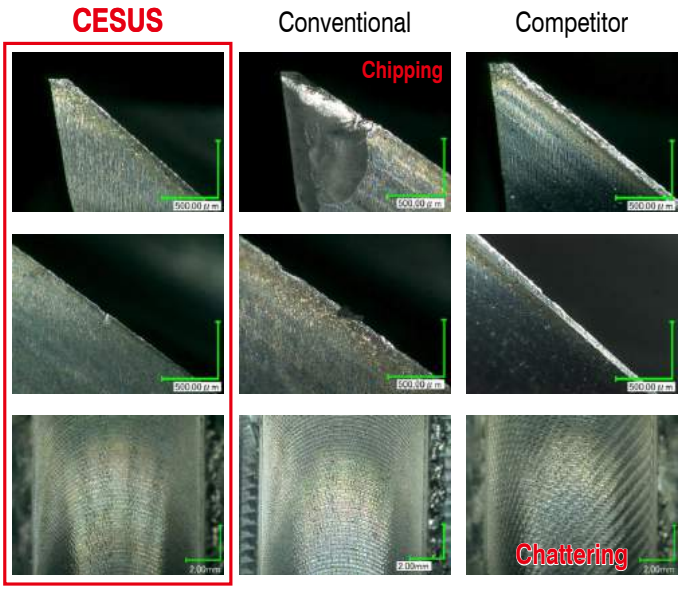


Slotting
a_p : Axial Depth (mm)
D : Outside Diameter (mm)

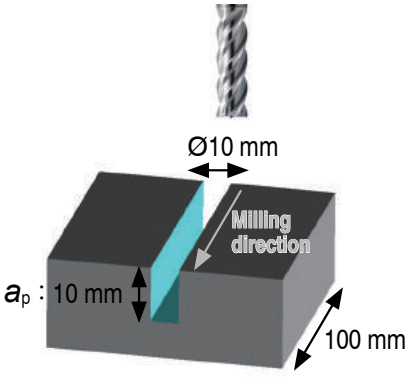
Milling Example for Slot Milling CESUS Ø 10 × Length of Cut 22 SUS304

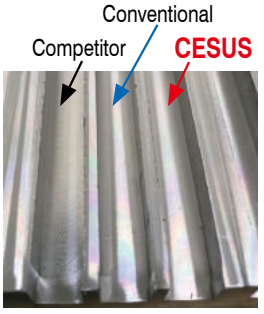
Tool	CESUS 4100-2200
Spindle Speed	3,200 min^{-1}
Feed Rate	900 mm/min
Axial Depth	10 mm
Coolant	Water soluble
Milling Distance	100 mm

*Milled by higher efficiency conditions than catalogue conditions to evaluate the tool performance.



Milling image



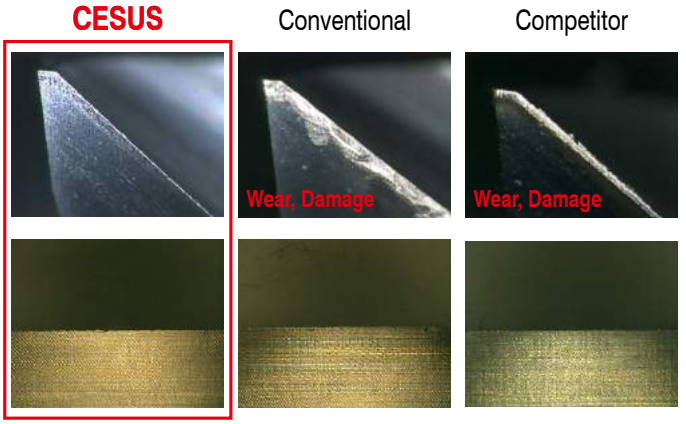


Slot milling surface

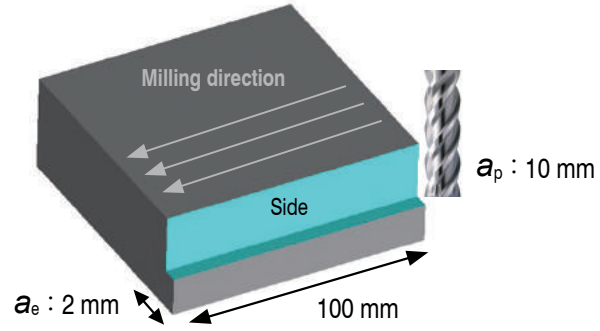
CESUS offers stable milling with less chattering under highly efficient conditions.

Milling Example for Side Milling CESUS Ø 10 × Length of Cut 22 SUS304

Tool	CESUS 4100-2200
Spindle Speed	2,560 min^{-1}
Feed Rate	580 mm/min
Axial Depth	10 mm
Radial Depth	2 mm
Coolant	Water soluble
Milling Distance	64.8 m
Milling Time	120 min



Milling image



CESUS offers longer tool life with less wear after 120 min milling!
Great surface finish without chattering!

4 Flutes UTCOAT

Size Ø1~Ø16

CXES

Super MG | UT COAT | 37°~40° | Flatland | Shank Dia 0/-0.005 | Variable Pitch | Variable Helix

Additional 11 models

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

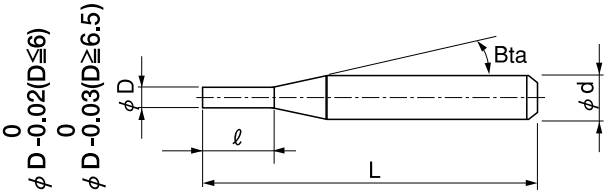
Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	○			○			◎			○	○		

Features

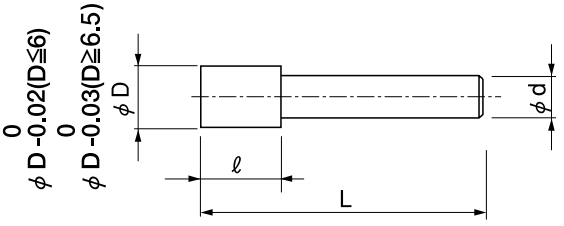
Variable Division & Helix design minimizes vibration and chattering.
Selected high toughness and chip resistant carbide material.
Optimized flute design offers outstanding high efficiency milling and fine finishing.
Low friction coating resulting in excellent chip evacuation and resistance to wear.

The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Shape A



Shape B



Total 41 models — Unit (mm)

	Model Number	Outside Diameter ØD	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Shape
	CXES 4010-0250	1	2.5	16°	50	4	A
※	**CXES 4010-0300**		3		60	4	
※	**CXES 4010-0400**		4		60	4	
	CXES 4015-0375	1.5	3.75	16°	50	4	A
	CXES 4020-0500	2	5	16°	50	4	A
※	**CXES 4020-0600**		6		60	4	
※	**CXES 4020-0800**		8		60	4	

※Additional model

Next Page ➡

	Model Number	Outside Diameter ØD	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Shape
	CXES 4025-0625	2.5	6.25	16°	50	4	A
	CXES 4030-0750	3	7.5	16°	50	6	A
	CXES 4030-0900		9		60	6	
※	CXES 4030-1200		12		60	6	
	CXES 4035-0900	3.5	9	16°	60	6	A
	CXES 4040-1000	4	10	16°	50	6	A
	CXES 4040-1200		12		60	6	
※	CXES 4040-1600		16		60	6	
	CXES 4045-1150	4.5	11.5	16°	60	6	A
	CXES 4050-1250	5	12.5	16°	50	6	A
	CXES 4050-1500		15		60	6	
※	CXES 4050-2000		20		60	6	
	CXES 4055-1400	5.5	14	16°	60	6	A
	CXES 4060-1500	6	15	-	50	6	A
	CXES 4060-1800		18		60	6	
※	CXES 4060-2400		24		70	6	
	CXES 4065-1650	6.5	16.5	16°	60	8	A
	CXES 4070-1050	7	10.5	-	100	6	B
	CXES 4075-1900	7.5	19	16°	60	8	A
	CXES 4080-2000	8	20	-	60	8	A
	CXES 4080-2400		24		70	8	
※	CXES 4080-3200		32		80	8	
	CXES 4085-2150	8.5	21.5	16°	70	10	A
	CXES 4090-1350	9	13.5	-	140	8	B
	CXES 4095-2400	9.5	24	16°	70	10	A
	CXES 4100-2500	10	25	-	70	10	A
	CXES 4100-3000		30		80	10	
※	CXES 4100-4000		40		90	10	
	CXES 4110-1650	11	16.5	-	150	10	B
	CXES 4120-3000	12	30	-	90	12	A
	CXES 4120-3600		36		100	12	
※	CXES 4120-4800		48		110	12	
	CXES 4130-1950	13	19.5	-	160	12	B
	CXES 4160-4000	16	40	-	110	16	A

※Additional model

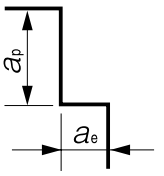
Milling Conditions for CXES

Side Milling

WORK MATERIAL			CARBON STEELS S45C / S50C Annealed Materials (～225HB)				ALLOY STEELS SK / SCM Annealed Materials (225～325HB)				STAINLESS STEELS SUS304 Use water soluble or oil coolant.			
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	a_e (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	a_e (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	a_e (mm)
4010-0250		2.5	18,000	620	2.5	0.2	18,000	460	2.5	0.2	14,500	320	2.5	0.1
4010-0300	**1**	3	18,000	620	3	0.03	18,000	460	3	0.03	14,300	310	3	0.015
4010-0400		4	18,000	620	4	0.02	18,000	460	4	0.02	13,900	290	4	0.01
4015-0375	**1.5**	3.75	13,500	770	3.75	0.3	13,500	570	3.75	0.3	13,300	340	3.75	0.15
4020-0500		5	11,000	930	5	0.4	11,000	690	5	0.4	12,200	360	5	0.2
4020-0600	**2**	6	11,000	930	6	0.06	11,000	690	6	0.06	12,000	340	6	0.03
4020-0800		8	11,000	930	8	0.04	11,000	690	8	0.04	11,600	300	8	0.02
4025-0625	**2.5**	6.25	9,500	1,060	6.25	0.5	9,500	800	6.25	0.5	11,000	490	6.25	0.25
4030-0750		7.5	8,500	1,200	7.5	0.6	8,500	900	7.5	0.6	10,000	640	7.5	0.3
4030-0900	**3**	9	8,500	1,200	9	0.3	8,500	900	9	0.3	9,100	580	9	0.15
4030-1200		12	8,500	1,200	12	0.06	8,500	900	12	0.06	7,300	460	12	0.03
4035-0900	**3.5**	9	7,800	1,250	9	0.7	7,500	950	9	0.7	8,600	680	9	0.35
4040-1000		10	7,200	1,350	10	0.8	6,700	1,000	10	0.8	7,500	730	10	0.4
4040-1200	**4**	12	7,200	1,350	12	0.4	6,700	1,000	12	0.4	6,600	640	12	0.2
4040-1600		16	7,200	1,350	16	0.08	6,700	1,000	16	0.08	4,800	460	16	0.08
4045-1150	**4.5**	11.5	6,550	1,400	11.5	0.9	6,000	1,050	11.5	0.9	6,300	770	11.5	0.45
4050-1250		12.5	6,000	1,500	12.5	1	5,400	1,100	12.5	1	5,400	810	12.5	0.5
4050-1500	**5**	15	6,000	1,500	15	0.5	5,400	1,100	15	0.5	4,600	690	15	0.25
4050-2000		20	6,000	1,500	20	0.1	5,400	1,100	20	0.1	3,700	450	20	0.1
4055-1400	**5.5**	14	5,450	1,550	14	1.1	4,900	1,150	14	1.1	4,900	810	14	0.55
4060-1500		15	5,000	1,600	15	1.2	4,500	1,200	15	1.2	4,500	810	15	0.6
4060-1800	**6**	18	5,000	1,600	18	0.6	4,500	1,200	18	0.6	3,700	660	18	0.3
4060-2400		24	5,000	1,400	24	0.12	4,500	1,050	24	0.12	2,900	360	24	0.12
4065-1650	**6.5**	16.5	4,400	1,500	16.5	1.3	3,950	1,150	16.5	1.3	3,950	780	16.5	0.65
4070-1050	**7**	10.5	3,900	1,450	10.5	0.7	3,550	1,120	10.5	0.7	3,550	760	10.5	0.35
4075-1900	**7.5**	19	3,500	1,400	19	1.5	3,250	1,100	19	1.5	3,250	750	19	0.75
4080-2000		20	3,000	1,300	20	1.6	2,900	1,050	20	1.6	2,900	720	20	0.8
4080-2400	**8**	24	2,800	1,230	24	0.8	2,600	1,050	24	0.8	2,600	600	24	0.4
4080-3200		32	2,400	1,090	32	0.16	2,000	800	32	0.16	2,100	360	32	0.16
4085-2150	**8.5**	21.5	2,550	1,200	21.5	1.7	2,450	1,000	21.5	1.7	2,450	680	21.5	0.85
4090-1350	**9**	13.5	2,250	1,150	13.5	0.9	2,150	980	13.5	0.9	2,150	650	13.5	0.45
4095-2400	**9.5**	24	1,950	1,050	24	1.9	1,900	950	24	1.9	1,900	620	24	0.95
4100-2500		25	1,600	1,000	25	2	1,500	900	25	2	1,500	580	25	1
4100-3000	**10**	30	1,500	900	30	1	1,500	850	30	1	1,500	580	30	0.5
4100-4000		40	1,300	800	40	0.2	1,500	750	40	0.2	1,500	580	40	0.2
4110-1650	**11**	16.5	1,400	900	16.5	1.1	1,350	830	16.5	1.1	1,350	560	16.5	0.55
4120-3000		30	1,200	800	30	2.4	1,200	750	30	2.4	1,200	540	30	1.2
4120-3600	**12**	36	1,150	750	36	1.2	1,150	720	36	1.2	1,150	540	36	0.6
4120-4800		48	1,050	700	48	0.24	1,050	660	48	0.24	1,050	500	48	0.24
4130-1950	**13**	19.5	1,100	650	19.5	1.3	1,100	600	19.5	1.3	1,000	460	19.5	0.65
4160-4000	**16**	40	1,000	500	40	3.2	1,000	440	40	3.2	720	340	40	1.6

Milling Conditions for CXES

WORK MATERIAL			PREHARDENED STEELS HPM / NAK (30~45HRC)				HARDENED STEELS SKD / SKT / STAVAX (45~55HRC)			
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	a_e (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	a_e (mm)
4010-0250		2.5	12,900	320	2.5	0.2	12,900	180	2.5	0.05
4010-0300	**1**	3	12,800	320	3	0.03	12,900	180	3	0.015
4010-0400		4	12,600	320	4	0.02	12,900	180	4	0.01
4015-0375	**1.5**	3.75	10,500	390	3.75	0.3	9,300	280	3.75	0.075
4020-0500		5	9,350	450	5	0.4	7,600	390	5	0.1
4020-0600	**2**	6	9,250	450	6	0.06	7,600	390	6	0.03
4020-0800		8	9,050	450	8	0.04	7,600	390	8	0.02
4025-0625	**2.5**	6.25	8,300	540	6.25	0.5	6,500	510	6.25	0.125
4030-0750		7.5	7,400	630	7.5	0.6	5,900	500	7.5	0.3
4030-0900	**3**	9	7,050	630	9	0.3	5,900	500	9	0.15
4030-1200		12	6,350	630	12	0.06	5,900	500	12	0.03
4035-0900	**3.5**	9	6,500	640	9	0.7	5,200	510	9	0.35
4040-1000		10	5,900	650	10	0.8	4,700	520	10	0.4
4040-1200	**4**	12	5,500	650	12	0.4	4,700	520	12	0.2
4040-1600		16	4,700	580	16	0.08	4,700	520	16	0.04
4045-1150	**4.5**	11.5	5,300	660	11.5	0.9	4,250	520	11.5	0.45
4050-1250		12.5	4,800	680	12.5	1	3,850	530	12.5	0.5
4050-1500	**5**	15	4,400	680	15	0.5	3,850	530	15	0.25
4050-2000		20	3,600	580	20	0.1	3,850	530	20	0.05
4055-1400	**5.5**	14	4,350	680	14	1.1	3,500	530	14	0.55
4060-1500		15	4,000	680	15	1.2	3,200	540	15	0.6
4060-1800	**6**	18	3,600	680	18	0.6	3,200	540	18	0.3
4060-2400		24	2,800	560	24	0.12	3,200	540	24	0.06
4065-1650	**6.5**	16.5	3,500	660	16.5	1.3	2,850	530	16.5	0.65
4070-1050	**7**	10.5	3,150	640	10.5	0.7	2,550	520	10.5	0.35
4075-1900	**7.5**	19	2,850	620	19	1.5	2,250	510	19	0.75
4080-2000		20	2,500	600	20	1.6	2,000	500	20	0.8
4080-2400	**8**	24	2,350	600	24	0.8	2,150	500	24	0.4
4080-3200		32	2,050	530	32	0.16	2,150	400	32	0.08
4085-2150	**8.5**	21.5	2,150	550	21.5	1.7	1,700	490	21.5	0.85
4090-1350	**9**	13.5	1,950	520	13.5	0.9	1,500	480	13.5	0.45
4095-2400	**9.5**	24	1,750	480	24	1.9	1,350	470	24	0.95
4100-2500		25	1,500	430	25	2	1,200	450	25	1
4100-3000	**10**	30	1,500	430	30	1	1,200	450	30	0.5
4100-4000		40	1,500	430	40	0.2	1,200	450	40	0.1
4110-1650	**11**	16.5	1,250	380	16.5	1.1	1,060	430	16.5	0.55
4120-3000		30	1,000	320	30	2.4	960	420	30	1.2
4120-3600	**12**	36	1,000	320	36	1.2	930	400	36	0.6
4120-4800		48	1,000	320	48	0.24	870	360	48	0.12
4130-1950	**13**	19.5	1,000	260	19.5	1.3	890	350	19.5	0.65
4160-4000	**16**	40	1,000	220	40	3.2	720	280	40	1.6



Side Milling
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

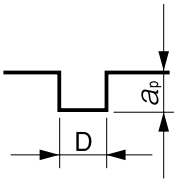
Milling Conditions for CXES

Slotting

WORK MATERIAL			CARBON STEELS S45C / S50C Annealed Materials (~225HB)			ALLOY STEELS SK / SCM Annealed Materials (225~325HB)			STAINLESS STEELS SUS304 Use water soluble or oil coolant.		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)
4010-0250		2.5	18,000	200	1	18,000	200	1	14,500	220	0.5
4010-0300	**1**	3	18,000	190※	0.5	18,000	190※	0.5	14,300	210※	0.25
4010-0400		4	18,000	170※	0.5	18,000	170※	0.5	12,500	190※	0.25
4015-0375	**1.5**	3.75	13,500	320	1.5	13,500	280	1.5	13,300	240	0.75
4020-0500		5	11,000	460	2	11,000	320	2	12,200	260	1
4020-0600	**2**	6	11,000	440※	1	11,000	310※	1	12,000	240※	0.5
4020-0800		8	11,000	400※	1	11,000	290※	1	11,600	200※	0.5
4025-0625	**2.5**	6.25	9,500	540	2.5	9,500	360	2.5	11,000	310	1.25
4030-0750		7.5	8,500	600	3	8,500	400	3	10,000	360	1.5
4030-0900	**3**	9	8,500	550	3	8,500	360	3	9,100	310	1.5
4030-1200		12	8,500	450※	1.5	8,500	280※	1.5	7,300	210※	0.75
4035-0900	**3.5**	9	7,800	620	3.5	7,500	420	3.5	8,600	380	1.75
4040-1000		10	7,200	650	4	6,700	450	4	7,500	400	2
4040-1200	**4**	12	7,200	580	4	6,700	400	4	6,600	320	2
4040-1600		16	7,200	440※	2	6,700	300※	2	4,800	200※	1
4045-1150	**4.5**	11.5	6,550	670	4.5	6,000	470	4.5	6,300	430	2.25
4050-1250		12.5	6,000	700	5	5,400	500	5	5,400	460	2.5
4050-1500	**5**	15	6,000	600	5	5,400	430	5	4,600	350	2.5
4050-2000		20	6,000	400※	2.5	5,400	290※	2.5	3,000	170※	1.25
4055-1400	**5.5**	14	5,450	700	5.5	4,900	500	5.5	4,900	460	2.75
4060-1500		15	5,000	700	6	4,500	500	6	4,500	460	3
4060-1800	**6**	18	5,000	560	6	4,500	410	6	3,700	320	3
4060-2400		24	5,000	280※	3	4,500	230※	3	2,100	150※	1.5
4065-1650	**6.5**	16.5	4,400	650	6.5	3,950	450	6.5	3,950	420	3.25
4070-1050	**7**	10.5	3,900	300	7	3,550	200	7	3,550	200	3.5
4075-1900	**7.5**	19	3,500	550	7.5	3,250	380	7.5	3,250	380	3.75
4080-2000		20	3,000	500	8	2,900	360	8	2,900	360	4
4080-2400	**8**	24	2,800	330	8	2,600	260	8	2,600	240	4
4080-3200		32	2,400	230※	4	2,000	180※	4	2,000	130※	2
4085-2150	**8.5**	21.5	2,550	450	8.5	2,450	330	8.5	2,450	310	4.25
4090-1350	**9**	13.5	2,250	210	9	2,150	160	9	2,150	140	4.5
4095-2400	**9.5**	24	1,950	400	9.5	1,900	300	9.5	1,900	250	4.75
4100-2500		25	1,600	380	10	1,500	270	10	1,500	220	5
4100-3000	**10**	30	1,500	250	10	1,500	180	10	1,500	190	5
4100-4000		40	1,300	180※	5	1,500	150※	5	1,500	130※	2.5
4110-1650	**11**	16.5	1,400	170	11	1,350	120	11	1,350	100	5.5
4120-3000		30	1,200	300	12	1,200	210	12	1,200	180	6
4120-3600	**12**	36	1,150	200	12	1,150	140	12	1,150	150	6
4120-4800		48	1,050	160※	6	1,050	120※	6	1,050	100※	3
4130-1950	**13**	19.5	1,100	190	13	1,100	90	13	1,000	80	6.5
4160-4000	**16**	40	1,000	400※	8	1,000	280※	8	720	240※	4
Milling Amount (mm)			a_p = 1D ※a_p = 0.5D			a_p = 1D ※a_p = 0.5D			a_p = 0.5D ※a_p = 0.25D		

Milling Conditions for CXES

WORK MATERIAL			PREHARDENED STEELS HPM / NAK (30～45HRC)			HARDENED STEELS SKD / SKT / STAVAX (45～55HRC)		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p (mm)
4010-0250		2.5	12,900	130	1	12,900	50※	0.3
4010-0300	**1**	3	12,800	120※2	0.5	setting disable	setting disable	setting disable
4010-0400		4	12,100	100※2	0.5	setting disable	setting disable	setting disable
4015-0375	**1.5**	3.75	10,500	180	1.5	10,500	100※	0.45
4020-0500		5	9,350	220	2	9,350	150※	0.6
4020-0600	**2**	6	9,300	200※2	1	setting disable	setting disable	setting disable
4020-0800		8	8,600	160※2	1	setting disable	setting disable	setting disable
4025-0625	**2.5**	6.25	8,300	270	2.5	8,300	240※	0.75
4030-0750		7.5	7,400	320	3	7,400	360	1.5
4030-0900	**3**	9	7,050	270	3	setting disable	setting disable	setting disable
4030-1200		12	6,350	170※2	1.5	setting disable	setting disable	setting disable
4035-0900	**3.5**	9	6,500	350	3.5	6,500	370	1.75
4040-1000		10	5,900	390	4	5,900	380	2
4040-1200	**4**	12	5,500	300	4	setting disable	setting disable	setting disable
4040-1600		16	4,700	160※2	2	setting disable	setting disable	setting disable
4045-1150	**4.5**	11.5	5,300	410	4.5	5,300	390	2.25
4050-1250		12.5	4,800	440	5	4,800	410	2.5
4050-1500	**5**	15	4,400	320	5	setting disable	setting disable	setting disable
4050-2000		20	3,600	160※2	2.5	setting disable	setting disable	setting disable
4055-1400	**5.5**	14	4,350	440	5.5	4,350	420	2.75
4060-1500		15	4,000	440	6	4,000	440	3
4060-1800	**6**	18	3,600	290	6	setting disable	setting disable	setting disable
4060-2400		24	2,800	140※2	3	setting disable	setting disable	setting disable
4065-1650	**6.5**	16.5	3,500	420	6.5	3,500	400	3.25
4070-1050	**7**	10.5	3,150	190	7	3,150	190	3.5
4075-1900	**7.5**	19	2,850	400	7.5	2,850	370	3.75
4080-2000		20	2,500	390	8	2,500	340	4
4080-2400	**8**	24	2,350	200	8	setting disable	setting disable	setting disable
4080-3200		32	2,050	110※2	4	setting disable	setting disable	setting disable
4085-2150	**8.5**	21.5	2,150	330	8.5	2,150	300	4.25
4090-1350	**9**	13.5	1,950	150	9	1,950	140	4.5
4095-2400	**9.5**	24	1,750	270	9.5	1,750	270	4.75
4100-2500		25	1,500	220	10	1,500	240	5
4100-3000	**10**	30	1,500	180※1	8	setting disable	setting disable	setting disable
4100-4000		40	1,200	90※2	5	setting disable	setting disable	setting disable
4110-1650	**11**	16.5	1,250	100	11	1,350	110	5.5
4120-3000		30	1,000	180	12	1,200	220	6
4120-3600	**12**	36	1,000	140※1	9.6	setting disable	setting disable	setting disable
4120-4800		48	800	70※2	6	setting disable	setting disable	setting disable
4130-1950	**13**	19.5	1,000	80	13	1,100	90	6.5
4160-4000	**16**	40	1,000	240※2	8	1,000	220※	4.8
Milling Amount (mm)			a_p = 1D ※1 a_p = 0.8D ※2 a_p = 0.5D			a_p = 0.5D ※a_p = 0.3D		



Slotting
a_p : Axial Depth (mm)
D : Outside Diameter (mm)

4 Flutes UTCOAT

Note:
・Decrease both spindle speed and feed rate proportionally in case of chattering.
・These milling parameters are calculated based on the shortest overhang length. Longer overhangs may require an adjustment to the milling parameters.
・Reduce the milling amount and feed rate in accordance with required milling precision.
・Every coolant offers stable milling.
・Recommend water soluble or oil coolant for Stainless Steels and Copper.

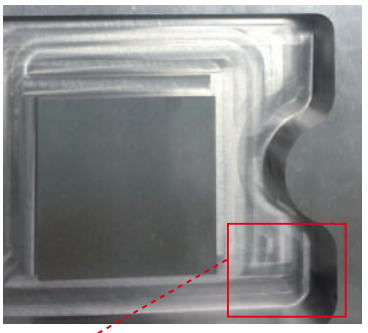
Milling Example CXES Ø 10 S55C

Roughing and finishing with a single tool

	Roughing		Finishing	
Tool	Conventional 4 Flutes	CXES 4100-2500	CXES 4100-2500	
Milling Part	Side / Groove		Bottom	Side
Spindle Speed	2,600 min^{-1}	2,500 min^{-1}	1,600 min^{-1}	
Feed Rate	525 mm/min	1,500 mm/min	380 mm/min	1,000 mm/min
Axial Depth	20 mm	19.9 mm	0.1 mm	0.1 mm
Radial Depth	0.7 mm	1.2 mm	0.4 mm	0.1 mm
Coolant	Oil		Oil	
Milling Distance	-	11.5 m	1.5 m	0.7 m
Efficiency *	1	4.8	-	

* Efficiency : Feed Rate × Axial Depth × Radial Depth

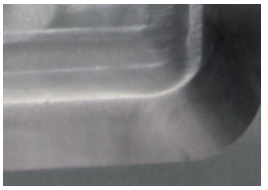
Size : 105 mm × 92 mm × 20 mm



Enlarged view

Finishing surface

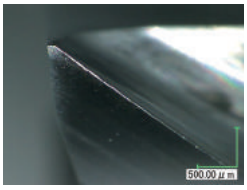
Bottom

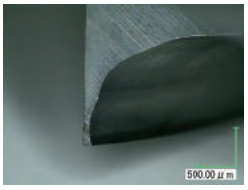


Side

No surface burrs after finishing process

4.8 times milling efficiency compared to conventional 4 flutes when roughing

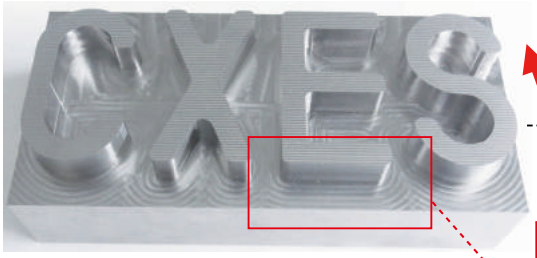




Total Milling Distance 21 m

Milling Example CXES Ø 6 SUS304

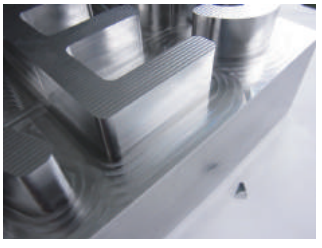
Tool	CXES4060-1500	
Milling Method	Roughing	Finishing
Spindle Speed	4,500 min^{-1}	4,500 min^{-1}
Feed Rate	810 mm/min	400 mm/min
Axial Depth a_p	15 mm	15 mm
Radial Depth a_e	0.6 mm	2.5 mm (Standing Wall Finishing Allowance)
Overhang Length	20 mm	20 mm
Coolant	Water Soluble (Through Spindle)	Water Soluble (Through Spindle)
Cycle Time	1:11:29	0:18:43



① Roughing Surface

② Finishing Surface

Enlarged view

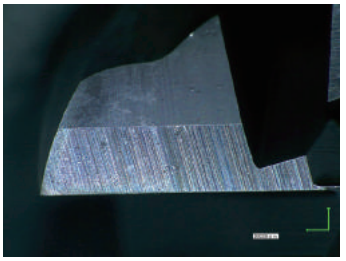


Smooth Side Finishing

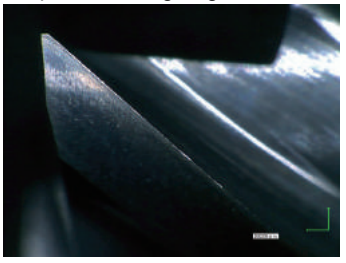
CXES milling video

Tool Wearing after Roughing Process

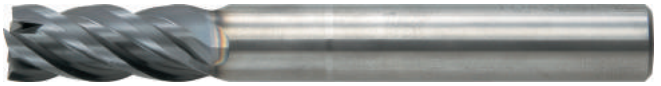
End Profile



Peripheral Cutting Edge



4 Flutes UTCOAT



Size Ø1~Ø20

CZS

Super MG | UT COAT | 40° | Flatland | Shank Dia 0/-0.005 | Variable Pitch

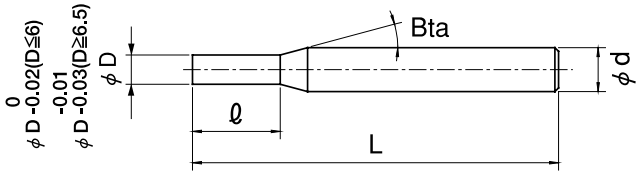
Patented in Japan, China, Korea, Taiwan, Germany, Switzerland, Liechtenstein, and Thailand

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	○			○	○		◎			○	○		

Features

The new tip geometry is ideal for vertical milling on horizontal surfaces.
The carbide grade specified offers excellent resistance to chipping.
The low friction characteristics of the coating offers excellent chip evacuation as well as longer tool life.



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 49 models — Unit (mm)

Model Number	Outside Diameter ØD	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
CZS 4010-0150	1	1.5	16°	50	4
CZS 4010-0250		2.5		50	4
CZS 4015-0225	1.5	2.25	16°	50	4
CZS 4015-0400		4		50	4
CZS 4020-0300	2	3	16°	50	4
CZS 4020-0600		6		50	4
CZS 4025-0375	2.5	3.75	16°	50	4
CZS 4025-0800		8		50	4
CZS 4030-0450	3	4.5	16°	60	6
CZS 4030-0800		8		60	6
CZS 4035-1000	3.5	10	16°	60	6
CZS 4040-0600	4	6	16°	60	6
CZS 4040-1100		11		60	6
CZS 4045-1100	4.5	11	16°	60	6

Next Page ➡

Unit（mm）

Model Number	Outside Diameter ØD	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
CZS 4050-0750	5	7.5	16°	60	6
CZS 4050-1300		13		60	6
CZS 4055-1300	5.5	13	16°	60	6
CZS 4060-0900	6	9	-	60	6
CZS 4060-1300		13		60	6
CZS 4060-1800		18		60	6
CZS 4065-1600	6.5	16	16°	70	8
CZS 4070-1050	7	10.5	16°	70	8
CZS 4070-1600		16		70	8
CZS 4070-2100		21		70	8
CZS 4075-1600	7.5	16	16°	70	8
CZS 4080-1200	8	12	-	70	8
CZS 4080-1900		19		70	8
CZS 4080-2400		24		70	8
CZS 4085-1900	8.5	19	16°	80	10
CZS 4090-1350	9	13.5	16°	80	10
CZS 4090-1900		19		80	10
CZS 4090-2700		27		80	10
CZS 4095-1900	9.5	19	16°	80	10
CZS 4100-1500	10	15	-	80	10
CZS 4100-2200		22		80	10
CZS 4100-3000		30		80	10
CZS 4105-2200	10.5	22	16°	100	12
CZS 4110-1650	11	16.5	16°	100	12
CZS 4110-2200		22		100	12
CZS 4110-3300		33		100	12
CZS 4115-2200	11.5	22	16°	100	12
CZS 4120-1800	12	18	-	100	12
CZS 4120-2600		26		100	12
CZS 4120-3600		36		100	12
CZS 4130-2600	13	26	-	110	12
CZS 4160-2400	16	24	-	110	16
CZS 4160-3200		32		110	16
CZS 4200-3000	20	30	-	125	20
CZS 4200-4000		40		125	20

CZS Series
S50C
Milling Video

Milling Conditions for CZS

◆ 1.5D flute length type

WORK MATERIAL			CARBON STEELS S45C / S50C Annealed Materials (~225HB)								
				Vertical		Slotting		Side Milling		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-0150	**1**	1.5	18,000	150	1	200	1	1,200※	1.5	0.1
4015-0225	**1.5**	2.25	16,000	200	1.5	550	1.5	1,800※	2.25	0.15
4020-0300	**2**	3	12,000	200	2	550	2	1,800※	3	0.2
4025-0375	**2.5**	3.75	10,000	300	2.5	950	2.5	2,400※	3.75	0.25
4030-0450	**3**	4.5	8,500	300	3	950	3	2,400※	4.5	0.3
4040-0600	**4**	6	7,200	300	4	950	4	1,350	6	0.8
4050-0750	**5**	7.5	6,000	300	5	1,000	5	1,500	7.5	1
4060-0900	**6**	9	5,000	300	6	1,000	6	1,600	9	1.2
4070-1050	**7**	10.5	4,200	300	7	1,000	7	1,500	10.5	1.4
4080-1200	**8**	12	3,500	300	8	950	8	1,400	12	1.6
4090-1350	**9**	13.5	2,900	300	9	950	9	1,300	13.5	1.8
4100-1500	**10**	15	2,300	300	10	900	10	1,200	15	2
4110-1650	**11**	16.5	2,050	280	11	900	11	1,150	16.5	2.2
4120-1800	**12**	18	1,850	260	12	850	12	1,100	18	2.4
4160-2400	**16**	24	1,380	150※	Step Amount: 1.6 Max 10 depth	830※	8	550	24	3.2
4200-3000	**20**	30	1,000	150※	Step Amount: 2 Max 10 depth	830※	10	500	30	4
Milling Amount (mm)				※ Depth: 1D Depth: 0.1D (Max 10 mm)		※ a_p:1D a_p:0.5D		※ a_p:0.2D a_e:0.1D	a_p:Length of Cut	

WORK MATERIAL			ALLOY STEELS SK / SCM Annealed Materials (225~325HB)								
				Vertical		Slotting		Side Milling		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-0150	**1**	1.5	14,500	50	1	150	1	900※	1.5	0.1
4015-0225	**1.5**	2.25	13,000	80	1.5	400	1.5	1,200※	2.25	0.15
4020-0300	**2**	3	10,000	80	2	400	2	1,200※	3	0.2
4025-0375	**2.5**	3.75	8,000	100	2.5	650	2.5	1,800※	3.75	0.25
4030-0450	**3**	4.5	6,800	100	3	650	3	1,800※	4.5	0.3
4040-0600	**4**	6	5,700	110	4	650	4	1,000	6	0.8
4050-0750	**5**	7.5	4,800	110	5	700	5	1,100	7.5	1
4060-0900	**6**	9	4,000	120	6	700	6	1,200	9	1.2
4070-1050	**7**	10.5	3,400	110※1	6	700	7	1,150	10.5	1.4
4080-1200	**8**	12	2,700	110※1	6	700	8	1,050	12	1.6
4090-1350	**9**	13.5	2,300	100※1	6	700	9	1,000	13.5	1.8
4100-1500	**10**	15	1,900	100※1	6	650	10	900	15	2
4110-1650	**11**	16.5	1,700	90※1	6	650	11	850	16.5	2.2
4120-1800	**12**	18	1,550	80※1	6	600	12	800	18	2.4
4160-2400	**16**	24	1,100	150※2	Step Amount: 1.6 Max 10 depth	400※	8	440	24	3.2
4200-3000	**20**	30	880	150※2	Step Amount: 2 Max 10 depth	400※	10	440	30	4
Milling Amount (mm)				※1 Depth: 1D Max 6 mm ※2 0.1D depth (Max 10 mm)		※ a_p:1D a_p:0.5D		※ a_p:0.2D a_e:0.1D	a_p:Length of Cut	

Milling Conditions for CZS

WORK MATERIAL			STRUCTURAL STEELS SS400 Recommend cutting oils. (Use cutting oils for vertical milling.)								
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Vertical		Slotting		Side Milling		
				Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-0150	**1**	1.5	18,000	100※1	0.25	400※1	0.25	1,200※	1.5	0.1
4015-0225	**1.5**	2.25	16,000	100※1	0.375	600※1	0.375	1,800※	2.25	0.15
4020-0300	**2**	3	12,000	200※1	0.5	600※1	0.5	1,800※	3	0.2
4025-0375	**2.5**	3.75	10,000	300	1.25	950	2.5	2,400※	3.75	0.25
4030-0450	**3**	4.5	8,500	300	1.5	950	3	2,400※	4.5	0.3
4040-0600	**4**	6	7,200	300	2	950	4	1,350	6	0.8
4050-0750	**5**	7.5	6,000	300	2.5	1,000	5	1,500	7.5	1
4060-0900	**6**	9	5,000	300	3	1,000	6	1,600	9	1.2
4070-1050	**7**	10.5	4,200	300	3.5	900	7	1,500	10.5	1.4
4080-1200	**8**	12	3,500	250	4	850	8	1,400	12	1.6
4090-1350	**9**	13.5	2,900	250	4.5	800	9	1,300	13.5	1.8
4100-1500	**10**	15	2,300	200	5	750	10	1,200	15	2
4110-1650	**11**	16.5	2,050	200	5.5	750	11	1,150	16.5	2.2
4120-1800	**12**	18	1,850	180	6	700	12	1,100	18	2.4
4160-2400	**16**	24	1,380	150※2	Step Amount: 1.6 Max 10 depth	830※2	8	550	24	3.2
4200-3000	**20**	30	1,000	150※2	Step Amount: 2 Max 10 depth	830※2	10	500	30	4
Milling Amount (mm)				Depth: 0.5D ※1 Depth: 0.25D ※2 Depth: 0.1D (Max 10 mm)		a_p:1D ※1 a_p:0.25D ※2 a_p:0.5D		a_p:Length of Cut a_e:0.2D ※ a_e:0.1D		

WORK MATERIAL			STAINLESS STEELS SUS304 Use cutting oils.								
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Vertical		Slotting		Side Milling		
				Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-0150	**1**	1.5	14,500	150	0.25	250	1	1,000※	1.5	0.05
4015-0225	**1.5**	2.25	13,000	150	0.375	270	1.5	1,500※	2.25	0.075
4020-0300	**2**	3	10,000	100	0.5	270	2	1,500※	3	0.1
4025-0375	**2.5**	3.75	8,000	100	0.625	300	2.5	2,000※	3.75	0.125
4030-0450	**3**	4.5	6,800	80	0.75	300	3	2,000※	4.5	0.15
4040-0600	**4**	6	5,700	90	1	350	4	1,150	6	0.4
4050-0750	**5**	7.5	4,800	100	1.25	400	5	1,300	7.5	0.5
4060-0900	**6**	9	4,000	100	1.5	400	6	1,300	9	0.6
4070-1050	**7**	10.5	3,200	100	1.75	350	7	1,300	10.5	0.7
4080-1200	**8**	12	2,400	90※	2	300	8	1,200	12	0.8
4090-1350	**9**	13.5	1,800	90※	2	250	9	1,100	13.5	0.9
4100-1500	**10**	15	1,400	80※	2	200	10	1,000	15	1
4110-1650	**11**	16.5	1,250	80※	2	200	11	900	16.5	1.1
4120-1800	**12**	18	1,250	70※	2	180	12	900	18	1.2
4160-2400	**16**	24	1,250	70※	2	450※	6.4	440	24	1.6
4200-3000	**20**	30	1,000	70※	2	450※	8	440	30	2
Milling Amount (mm)				※ Depth: 0.25D Max 2 mm depth		a_p:1D ※ a_p:0.4D		a_p:Length of Cut a_e:0.1D ※ a_e:0.05D		

Milling Conditions for CZS

WORK MATERIAL			PREHARDENED STEELS HPM / NAK (30~45HRC)								
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Vertical		Slotting		Side Milling		
				Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-0150	**1**	1.5	14,500	100	0.5	120	1	600※	1.5	0.05
4015-0225	**1.5**	2.25	12,000	150	0.75	320	1.5	900※	2.25	0.075
4020-0300	**2**	3	9,000	150	1	320	2	900※	3	0.1
4025-0375	**2.5**	3.75	7,500	200	1.25	520	2.5	1,200※	3.75	0.125
4030-0450	**3**	4.5	6,800	200	1.5	520	3	1,200※	4.5	0.15
4040-0600	**4**	6	5,100	220	2	520	4	700	6	0.4
4050-0750	**5**	7.5	4,050	240	2.5	520	5	850	7.5	0.5
4060-0900	**6**	9	3,300	240	3	520	6	1,000	9	0.6
4070-1050	**7**	10.5	2,900	240※	3	500※1	6	1,000	10.5	0.7
4080-1200	**8**	12	2,300	220※	3	470※1	6	900	12	0.8
4090-1350	**9**	13.5	1,900	220※	3	470※1	6	900	13.5	0.9
4100-1500	**10**	15	1,500	200※	3	450※1	6	900	15	1
4110-1650	**11**	16.5	1,350	200※	3	450※1	6	850	16.5	1.1
4120-1800	**12**	18	1,200	180※	3	420※1	6	800	18	1.2
4160-2400	**16**	24	1,110	150※	3	400※2	4~8	440※	24	0.8
4200-3000	**20**	30	880	150※	3	400※2	5~10	440※	30	1
Milling Amount (mm)				※ Depth: 0.5D Max 3 mm depth		※1 a_p:1D a_p:Max 6 mm ※2 a_p:1D a_p:0.25~0.5D		※ a_p:Length of Cut a_e:0.1D a_e:0.05D		

WORK MATERIAL			HARDENED STEELS SKD / SKT / STAVAX (45~55HRC)								
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Vertical		Slotting		Side Milling		
				Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-0150	**1**	1.5	12,900	80	0.25	50※1	0.25	300※	1.5	0.05
4015-0225	**1.5**	2.25	10,000	150	0.375	100※1	0.375	650※	2.25	0.075
4020-0300	**2**	3	8,200	150	0.5	150※1	0.5	650※	3	0.1
4025-0375	**2.5**	3.75	7,000	250	0.625	300	2.5	1,000※	3.75	0.125
4030-0450	**3**	4.5	6,120	250	0.75	300	3	1,000※	4.5	0.15
4040-0600	**4**	6	5,000	220	1	320	4	600	6	0.4
4050-0750	**5**	7.5	4,300	180	1.25	340	5	800	7.5	0.5
4060-0900	**6**	9	3,600	160	1.5	360	6	1,000	9	0.6
4070-1050	**7**	10.5	2,800	160※	1.5	320	7	1,000	10.5	0.7
4080-1200	**8**	12	2,100	150※	1.5	280	8	1,000	12	0.8
4090-1350	**9**	13.5	1,600	130※	1.5	240	9	950	13.5	0.9
4100-1500	**10**	15	1,250	120※	1.5	200	10	750	15	1
4110-1650	**11**	16.5	1,150	110※	1.5	190	11	720	16.5	1.1
4120-1800	**12**	18	1,050	110※	1.5	180	12	700	18	1.2
4160-2400	**16**	24	800	50※	1.5	300※2	1.6	320※	24	0.8
4200-3000	**20**	30	630	50※	1.5	300※2	2	320※	30	1
Milling Amount (mm)				※ Depth: 0.25D Max 1.5 mm		※1 a_p:1D a_p:0.25D ※2 a_p:1D a_p:0.1D		※ a_p:Length of Cut a_e:0.1D a_e:0.05D		

Milling Conditions for CZS

◆ Standard flute length type

WORK MATERIAL			CARBON STEELS S45C / S50C Annealed Materials (~225HB)							
				Vertical		Slotting		Side Milling		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-0250	**1**	2.5	18,000	100	1	200※	0.5	1,200※	1.5	0.1
4020-0600	**2**	6	12,000	150	2	400※	1	1,800※	3	0.2
4030-0800	**3**	8	8,500	250	3	600	3	2,400※	4.5	0.3
4040-1100	**4**	11	7,200	270	4	650	4	1,350	6	0.8
4050-1300	**5**	13	6,000	300	5	700	5	1,500	7.5	1
4060-1300	**6**	13	5,000	300	6	700	6	1,600	9	1.2
4070-1600	**7**	16	4,200	300	7	700	7	1,500	10.5	1.4
4080-1900	**8**	19	3,500	300	8	700	8	1,400	12	1.6
4090-1900	**9**	19	2,900	300	9	700	9	1,300	13.5	1.8
4100-2200	**10**	22	2,300	300	10	700	10	1,200	15	2
4110-2200	**11**	22	2,050	280	11	670	11	1,150	16.5	2.2
4120-2600	**12**	26	1,850	260	12	650	12	1,100	18	2.4
4130-2600	**13**	26	1,400	80	13	300	13	700※	19.5	1.3
4160-3200	**16**	32	1,380	150※	Step Amount: 1.6 Max 10 depth	830※	8	550	24	3.2
4200-4000	**20**	40	1,000	150※	Step Amount: 2 Max 10 depth	830※	10	500	30	4
Milling Amount (mm)				※ Depth: 1D Depth: 0.1D (Max 10 mm)		a_p:1D ※ a_p:0.5D		a_p:1.5D a_e:0.2D ※ a_e:0.1D		

WORK MATERIAL			ALLOY STEELS SK / SCM Annealed Materials (225~325HB)							
				Vertical		Slotting		Side Milling		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-0250	**1**	2.5	14,500	50	1	150※	0.5	900※	1.5	0.1
4020-0600	**2**	6	10,000	80	2	300※	1	1,200※	3	0.2
4030-0800	**3**	8	6,800	100	3	400	3	1,800※	4.5	0.3
4040-1100	**4**	11	5,700	110	4	450	4	1,000	6	0.8
4050-1300	**5**	13	4,800	110	5	500	5	1,100	7.5	1
4060-1300	**6**	13	4,000	120	6	500	6	1,200	9	1.2
4070-1600	**7**	16	3,400	110※1	6	500	7	1,150	10.5	1.4
4080-1900	**8**	19	2,700	110※1	6	500	8	1,050	12	1.6
4090-1900	**9**	19	2,300	100※1	6	500	9	1,000	13.5	1.8
4100-2200	**10**	22	1,900	100※1	6	500	10	900	15	2
4110-2200	**11**	22	1,700	90※1	6	450	11	850	16.5	2.2
4120-2600	**12**	26	1,550	80※1	6	450	12	800	18	2.4
4130-2600	**13**	26	1,100	25※1	6	180	13	550※	19.5	1.3
4160-3200	**16**	32	1,100	150※2	Step Amount: 1.6 Max 10 depth	300※	8	440	24	3.2
4200-4000	**20**	40	880	150※2	Step Amount: 2 Max 10 depth	300※	10	440	30	4
Milling Amount (mm)				Depth: 1D ※1 Max 6 mm ※2 Depth: 0.1D (Max 10 mm)		a_p:1D ※ a_p:0.5D		a_p:1.5D a_e:0.2D ※ a_e:0.1D		

Milling Conditions for CZS

WORK MATERIAL			STRUCTURAL STEELS SS400 Recommend cutting oils. (Use cutting oils for vertical milling.)							
				Vertical		Slotting		Side Milling		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-0250	**1**	2.5	18,000	100※1	0.25	400※1	0.25	1,200※	1.5	0.1
4020-0600	**2**	6	12,000	200※1	0.5	600※1	0.5	1,800※	3	0.2
4030-0800	**3**	8	8,500	300	1.5	600	3	2,400※	4.5	0.3
4040-1100	**4**	11	7,200	300	2	650	4	1,350	6	0.8
4050-1300	**5**	13	6,000	300	2.5	700	5	1,500	7.5	1
4060-1300	**6**	13	5,000	300	3	700	6	1,600	9	1.2
4070-1600	**7**	16	4,200	270	3.5	700	7	1,500	10.5	1.4
4080-1900	**8**	19	3,500	250	4	700	8	1,400	12	1.6
4090-1900	**9**	19	2,900	220	4.5	700	9	1,300	13.5	1.8
4100-2200	**10**	22	2,300	200	5	700	10	1,200	15	2
4110-2200	**11**	22	2,050	190	5.5	680	11	1,150	16.5	2.2
4120-2600	**12**	26	1,850	180	6	650	12	1,100	18	2.4
4130-2600	**13**	26	1,100	55	6.5	180	13	550※	19.5	1.3
4160-3200	**16**	32	1,380	150※2	Step Amount: 1.6 Max 10 depth	830※2	8	550	24	3.2
4200-4000	**20**	40	1,000	150※2	Step Amount: 2 Max 10 depth	830※2	10	500	30	4
Milling Amount (mm)				Depth: 0.5D ※1 Depth: 0.25D ※2 Depth: 0.1D (Max 10 mm)		a_p:1D ※1 a_p:0.25D ※2 a_p:0.5D		a_p:1.5D a_e:0.2D ※ a_e:0.1D		

WORK MATERIAL			STAINLESS STEELS SUS304 Use cutting oils.							
				Vertical		Slotting		Side Milling		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-0250	**1**	2.5	14,500	150	0.25	250	0.5	1,000※	1.5	0.05
4020-0600	**2**	6	10,000	100	0.5	270	1	1,500※	3	0.1
4030-0800	**3**	8	6,800	80	0.75	300	1.5	2,000※	4.5	0.15
4040-1100	**4**	11	5,700	90	1	350	2	1,150	6	0.4
4050-1300	**5**	13	4,800	100	1.25	400	2.5	1,300	7.5	0.5
4060-1300	**6**	13	4,000	100	1.5	400	3	1,300	9	0.6
4070-1600	**7**	16	3,200	100	1.75	350	3.5	1,300	10.5	0.7
4080-1900	**8**	19	2,400	90※1	2	300	4	1,200	12	0.8
4090-1900	**9**	19	1,800	90※1	2	250	4.5	1,100	13.5	0.9
4100-2200	**10**	22	1,400	80※1	2	200	5	1,000	15	1
4110-2200	**11**	22	1,250	80※1	2	200	5.5	900	16.5	1.1
4120-2600	**12**	26	1,250	70※1	2	180	6	900	18	1.2
4130-2600	**13**	26	1,050	20※2	1.5	120	6.5	900※	19.5	0.65
4160-3200	**16**	32	1,250	70※1	2	450※	1.6	440	24	1.6
4200-4000	**20**	40	1,000	70※1	2	450※	2	440	30	2
Milling Amount (mm)				Depth: 0.25D ※1 Max 2 mm depth ※2 Max 1.5 mm depth		a_p:0.5D ※ a_p:0.1D		a_p:1.5D a_e:0.1D ※ a_e:0.05D		

Milling Conditions for CZS

WORK MATERIAL			PREHARDENED STEELS HPM / NAK (30~45HRC)							
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Vertical		Slotting		Side Milling		
				Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-0250	**1**	2.5	12,900	80	0.5	140	1	270	1.5	0.2
4020-0600	**2**	6	9,350	110	1	230	2	400	3	0.4
4030-0800	**3**	8	6,120	120	1.5	270	3	450	4.5	0.6
4040-1100	**4**	11	5,250	130	2	320	4	500	6	0.8
4050-1300	**5**	13	4,460	150	2.5	360	5	540	7.5	1
4060-1300	**6**	13	3,600	160	3	360	6	540	9	1.2
4070-1600	**7**	16	2,850	140※	2	340	7	540	10.5	1.4
4080-1900	**8**	19	2,320	90※	2	320	8	480	12	1.6
4090-1900	**9**	19	1,700	80※	2	250	9	410	13.5	1.8
4100-2200	**10**	22	1,250	60※	2	180	10	340	15	2
4110-2200	**11**	22	1,100	55※	2	170	11	320	16.5	2.2
4120-2600	**12**	26	1,050	50※	2	160	12	320	18	2.4
4130-2600	**13**	26	1,000	setting disable	setting disable	100※	6.5	300※	19.5	1.3
4160-3200	**16**	32	960	40※	2	350※	8	380※	24	1.6
4200-4000	**20**	40	770	40※	2	350※	10	380※	30	2
Milling Amount (mm)				※ Depth: 0.5D Max 2 mm depth		a_p:1D ※ a_p:0.5D		a_p:1.5D a_e:0.2D ※ a_e:0.1D		

WORK MATERIAL			HARDENED STEELS SKD / SKT / STAVAX (45~55HRC)							
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Vertical		Slotting		Side Milling		
				Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-0250	**1**	2.5	12,900	80	0.25	50※1	0.25	300※	1.5	0.05
4020-0600	**2**	6	8,200	150	0.5	150※1	0.5	650※	3	0.1
4030-0800	**3**	8	6,120	250	0.75	300	1.5	1,000※	4.5	0.15
4040-1100	**4**	11	5,000	220	1	320	2	500	6	0.4
4050-1300	**5**	13	4,300	180	1.25	340	2.5	520	7.5	0.5
4060-1300	**6**	13	3,600	160	1.5	360	3	540	9	0.6
4070-1600	**7**	16	2,800	160※1	1.5	320	3.5	520	10.5	0.7
4080-1900	**8**	19	2,100	150※1	1.5	280	4	500	12	0.8
4090-1900	**9**	19	1,600	130※1	1.5	240	4.5	470	13.5	0.9
4100-2200	**10**	22	1,250	120※1	1.5	200	5	450	15	1
4110-2200	**11**	22	1,150	110※1	1.5	190	5.5	440	16.5	1.1
4120-2600	**12**	26	1,050	110※1	1.5	180	6	420	18	1.2
4130-2600	**13**	26	900	setting disable	setting disable	setting disable	setting disable	370※	19.5	0.65
4160-3200	**16**	32	800	50※2	Step Amount: 1.6 Max 10 depth	300※2	1.6	320※	24	0.8
4200-4000	**20**	40	630	50※2	Step Amount: 2 Max 10 depth	300※2	2	320※	30	1
Milling Amount (mm)				Depth: 0.25D ※1 Max 1.5 mm ※2 Depth: 0.1D (Max 10 mm)		a_p:0.5D ※1 a_p:0.25D ※2 a_p:0.1D		a_p:1.5D a_e:0.1D ※ a_e:0.05D		

Milling Conditions for CZS

◆3D flute length type

WORK MATERIAL			CARBON STEELS S45C / S50C Annealed Materials (~225HB)								
				Vertical		Slotting		Side Milling		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4060-1800	**6**	18	5,000	200	6	500	6	1,600	18	0.6
4070-2100	**7**	21	4,100	200	7	450	7	1,450	21	0.7
4080-2400	**8**	24	3,200	150	8	400	8	1,300	24	0.8
4090-2700	**9**	27	2,400	140	9	350	9	1,150	27	0.9
4100-3000	**10**	30	1,850	120	10	320	10	1,000	30	1
4110-3300	**11**	33	1,650	100	11	300	11	900	33	1.1
4120-3600	**12**	36	1,500	90	12	300	12	800	36	1.2
Milling Amount (mm)				Depth: 1D		a_p:1D		a_p:Length of Cut a_e:0.1D		

WORK MATERIAL			ALLOY STEELS SK / SCM Annealed Materials (225~325HB)								
				Vertical		Slotting		Side Milling		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4060-1800	**6**	18	4,000	60	6	350	6	1,200	18	0.6
4070-2100	**7**	21	3,400	60	6	330	7	1,150	21	0.7
4080-2400	**8**	24	2,700	50	6	300	8	1,050	24	0.8
4090-2700	**9**	27	2,050	50	6	270	9	1,000	27	0.9
4100-3000	**10**	30	1,500	40	6	240	10	900	30	1
4110-3300	**11**	33	1,350	40	6	220	11	850	33	1.1
4120-3600	**12**	36	1,200	30	6	200	12	750	36	1.2
Milling Amount (mm)				Max 6 mm depth		a_p:1D		a_p:Length of Cut a_e:0.1D		

WORK MATERIAL			STRUCTURAL STEELS SS400 Recommend cutting oils. (Use cutting oils for vertical milling.)								
				Vertical		Slotting		Side Milling		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4060-1800	**6**	18	4,000	120	3	300	6	1,300	18	0.6
4070-2100	**7**	21	3,400	110	3.5	280	7	1,200	21	0.7
4080-2400	**8**	24	2,700	90	4	250	8	1,150	24	0.8
4090-2700	**9**	27	2,100	80	4.5	230	9	1,050	27	0.9
4100-3000	**10**	30	1,500	70	5	200	10	1,000	30	1
4110-3300	**11**	33	1,350	65	5.5	190	11	950	33	1.1
4120-3600	**12**	36	1,200	60	6	190	12	900	36	1.2
Milling Amount (mm)				Depth: 0.5D		a_p:1D		a_p:Length of Cut a_e:0.1D		

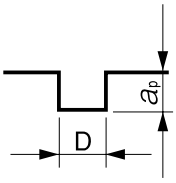
Milling Conditions for CZS

WORK MATERIAL			STAINLESS STEELS SUS304 Use cutting oils.							
				Vertical		Slotting		Side Milling		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4060-1800	**6**	18	2,800	40	1.5	200	3	900	18	0.3
4070-2100	**7**	21	2,450	40	1.5	190	3.5	950	21	0.35
4080-2400	**8**	24	2,100	40	1.5	180	4	950	24	0.4
4090-2700	**9**	27	1,700	30	1.5	170	4.5	1,000	27	0.45
4100-3000	**10**	30	1,400	30	1.5	150	5	1,000	30	0.5
4110-3300	**11**	33	1,250	30	1.5	140	5.5	1,000	33	0.55
4120-3600	**12**	36	1,150	25	1.5	130	6	950	36	0.6
Milling Amount (mm)				Max 1.5 mm depth		a_p:0.5D		a_p:Length of Cut a_e:0.05D		

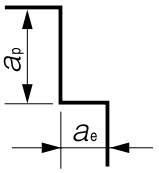
WORK MATERIAL			PREHARDENED STEELS HPM / NAK (30~45HRC)							
				Vertical		Slotting		Side Milling		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4060-1800	**6**	18	3,000	—	—	160	6	600	18	0.3
4070-2100	**7**	21	2,500	—	—	160	6	700	21	0.35
4080-2400	**8**	24	2,150	—	—	150	6	750	24	0.4
4090-2700	**9**	27	1,850	—	—	150	6	800	27	0.45
4100-3000	**10**	30	1,500	—	—	140	6	900	30	0.5
4110-3300	**11**	33	1,350	—	—	130	6	850	33	0.55
4120-3600	**12**	36	1,200	—	—	120	6	800	36	0.6
Milling Amount (mm)				setting disable		a_p:Max 6 mm		a_p:Length of Cut a_e:0.05D		

WORK MATERIAL			HARDENED STEELS SKD / SKT / STAVAX (45~55HRC)							
				Vertical		Slotting		Side Milling		
Model Number	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4060-1800	**6**	18	3,600	—	—	—	—	540	18	0.3
4070-2100	**7**	21	2,900	—	—	—	—	520	21	0.35
4080-2400	**8**	24	2,300	—	—	—	—	500	24	0.4
4090-2700	**9**	27	1,700	—	—	—	—	470	27	0.45
4100-3000	**10**	30	1,250	—	—	—	—	450	30	0.5
4110-3300	**11**	33	1,100	—	—	—	—	420	33	0.55
4120-3600	**12**	36	1,000	—	—	—	—	400	36	0.6
Milling Amount (mm)				setting disable		setting disable		a_p:Length of Cut a_e:0.05D		

Milling Conditions for CZS



Slotting
a_p : Axial Depth (mm)
D : Outside Diamater (mm)



Side Milling
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

Note:
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when burr and red-hot occur.
- These milling parameters are calculated based on the shortest overhang length. Longer overhangs may require an adjustment to the milling parameters.
- Reduce the milling amount and feed rate in accordance with required milling precision.
- Spindle rigidity should be considered when setting milling parameters, especially for Z-Axis drilling.
- When slotting, using Z-Axis drilling, the milling parameters should promote good chip evacuation.
- Reduce the milling amount when chips clog on the tool during Z-Axis drilling.
- The milling parameter of outside diameter 16 and 20 is calculated based on MT50 spindle type. Decrease 50% milling amount for BT40 spindle type.
- Adjust the feed rate with indication following the conditions in milling amount columns.
- Recommend water soluble or oil coolant.
- Recommend water soluble coolant (through-spindle type) for Stainless Steels and Aluminum Alloys.
- Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.

4 Flute UTCOAT Square End Mills for Part Milling

CZS The 2 in 1 Advantage

Patented special end profile design

Drilling and Milling in a Single Tool! 1/2 Cycle Time!

Tool	ϕ8 x 12 mm Length of Cut
Work Material	SCM420H
Spindle Speed	2,700 min^{-1}
Z-Drilling Feed Rate	220 mm/min
X-Y Milling Feed Rate	500 mm/min
Coolant	Water Soluble

Z-drilling: 1 mm depth x 4 times Dwell: 0.1 sec

Pocket Size:
9 mm × 15 mm × 4 mm

Drilling and Milling: 144 min

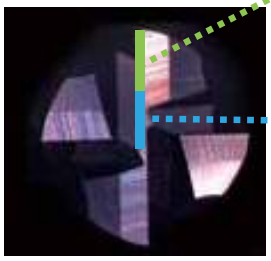
CZS → 72 min

More tool life left after milling 864 holes (32 pieces)!

Drilling Mechanism

Normal 4 Flutes

Conventional End Profile



Chips made by the main flutes outer edge → Bigger

Chips made by the inner edge →Trapped

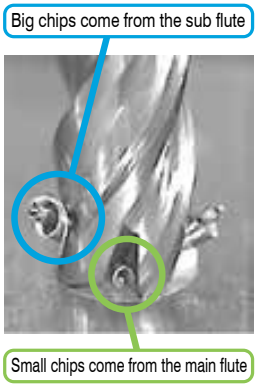
Normal 4 flute end mill easily clogs

Impossible to Drill

The outer edge of the main flutes are not used in the drilling cycle

Gap on Main Flute

CZS



Chips made by the main flutes inner edge evacuate smoothly

Giving High Speed Drilling

Variable Pitch Prevents Chattering!

Tool	ϕ6.5 x 16 mm Length of Cut
Work Material	S45C (Ø 18)
Spindle Speed	2,200 min^{-1}
Z-Drilling Feed Rate	100 mm/min
X-Y Milling Feed Rate	400 mm/min
Axial Depth a_p	3 mm
Overhang	25 mm
Coolant	Air Blow (Through Spindle)

CZS

Conventional 4 Flutes

4 Flutes HARDMAX

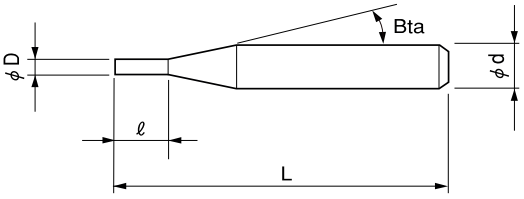
Size Ø1~Ø12

HMES SP

Super MG | HARD MAX | 40° | Flatland | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	◎	◎		○			○			○	○		



The shank taper angle shown is not an exact value and to avoid contact with the workpiece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 15 models Unit (mm)

Model Number	Outside Diameter ØD	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HMES SP 4010-0250	1	2.5	16°	45	4
HMES SP 4015-0375	1.5	3.75		45	4
HMES SP 4020-0500	2	5		45	4
HMES SP 4025-1000	2.5	10		50	4
HMES SP 4030-0750	3	7.5		45	6
HMES SP 4030-1200		12		50	6
HMES SP 4040-1000	4	10		50	6
HMES SP 4040-1600		16		60	6
HMES SP 4060-1500	6	15	-	50	6
HMES SP 4060-2400		24		60	6
HMES SP 4080-2000	8	20	-	60	8
HMES SP 4080-3200		32		80	8
HMES SP 4100-2500	10	25	-	70	10
HMES SP 4100-4000		40		90	10
HMES SP 4120-3000	12	30	-	75	12

Milling Conditions for HMES SP

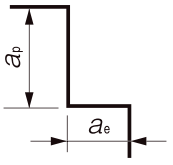
WORK MATERIAL		CARBON STEELS S45C/S50C (~225HB)			ALLOY STEELS SK/SCM/SUS (225~325HB)			PREHARDENED STEELS HARDENED STEELS NAK/SKD (30 ~ 45HRC)			HARDENED STEELS SKD11/61/SKT (45 ~ 55HRC)		
Model Number	Outside Diameter (mm)	Spindle Speed (min^{-1})	Velocity (m/min)	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Velocity (m/min)	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Velocity (m/min)	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Velocity (m/min)	Feed Rate (mm/min)
4010	**1**	20,000	(65)	240	15,000	(45)	215	11,000	(35)	85	7,100	(20)	40
4015	**1.5**	13,500		245	10,000		215	8,000		90	5,100		50
4020	**2**	11,000	(70~85)	245	8,500	(55~65)	215	6,400	(40~45)	90	4,000	(25~30)	55
4025	**2.5**	8,800		370	7,000		245	5,000		90	3,200		55
4030	**3**	7,400		370	6,400		260	4,500		105	2,800		65
4040	**4**	5,900		435	5,000		340	3,500		120	2,150		70
4050	**5**	5,300		590	4,200		415	2,950		120	1,850		75
4060	**6**	4,400		580	3,500		415	2,450		130	1,500		70
4080	**8**	3,300		550	2,600		415	1,850		125	1,200		70
4100	**10**	2,600		525	2,100		405	1,450		125	950		65
4120	**12**	2,200		525	1,750		405	1,200		120	800		60

◆High speed milling

WORK MATERIAL		CARBON STEELS S45C/S50C (~225HB)			ALLOY STEELS SK/SCM/SUS (225~325HB)			PREHARDENED STEELS HARDENED STEELS NAK/SKD (30 ~ 45HRC)			HARDENED STEELS SKD11/61/SKT (45 ~ 55HRC)		
Model Number	Outside Diameter (mm)	Spindle Speed (min^{-1})	Velocity (m/min)	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Velocity (m/min)	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Velocity (m/min)	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Velocity (m/min)	Feed Rate (mm/min)
4030	**3**	30,000	(300)	1,500	26,500	(250)	1,075	21,200	(200)	495	15,800	(150)	365
4040	**4**	23,800		1,755	19,800		1,345	15,800		540	11,900		385
4050	**5**	19,000		2,115	15,800		1,560	12,700		515	9,500		385
4060	**6**	15,900		2,095	13,200		1,565	10,600		560	7,900		370
4080	**8**	11,900		1,985	9,900		1,580	7,900		535	5,900		345
4100	**10**	9,500		1,920	7,900		1,525	6,300		545	4,700		320
4120	**12**	7,900		1,885	6,600		1,525	5,300		530	3,900		295

Milling amount for side milling (mm)

Length of Cut / Material	2.5D or below	Below 3D	3D or above
45HRC or below	a_e : 0.07D a_p : 2D	a_e : 0.05D a_p : 2.5D	a_e : 0.02D a_p : 3.5D
45HRC or above	a_e : 0.03D a_p : 1.5D	a_e : 0.02D a_p : 2D	a_e : 0.01D a_p : 3D



D : Outside Diameter (mm)
Ex.) 2D or below : Flute Length = Diameter × 2 or below
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

Note :
- Recommend water soluble or oil coolant.
- Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.

Size Ø1~Ø12

HMS

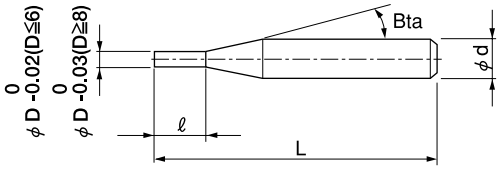
Super MG | HARD MAX | 45° | Flatland | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
		○	◎	◎	◎ ~65HRC										

Features

Offering outstanding tool life by selecting appropriate 3, 4 or 6 flutes on each tool diameter.
Highly efficient milling on hard materials up to 65HRC with high hardness coating, HARDMAX COAT .
Suitable for both dry and wet coolant types.



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 27 models Unit (mm)

Model Number	Outside Diameter ØD	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Number of Flutes
HMS 3010-0250	1	2.5	16°	45	4	3
HMS 3010-0350		3.5		45	4	
HMS 3015-0400	1.5	4	16°	45	4	3
HMS 3015-0600		6		45	4	
HMS 3020-0400	2	4	16°	45	4	3
HMS 3020-0700		7		45	4	
HMS 3030-0600	3	6	16°	50	6	3
HMS 3030-1000		10		60	6	
HMS 3030-1500		15		60	6	
HMS 4040-0800	4	8	16°	50	6	4
HMS 4040-1200		12		60	6	
HMS 4040-2000		20		70	6	
HMS 4050-1000	5	10	16°	50	6	4
HMS 4050-1500		15		60	6	
HMS 4050-2500		25		70	6	
HMS 6060-1300	6	13	-	50	6	6
HMS 6060-1800		18		60	6	
HMS 6060-2600		26		70	6	
HMS 6080-1900	8	19	-	60	8	6
HMS 6080-2400		24		70	8	
HMS 6080-3600		36		90	8	
HMS 6100-2200	10	22	-	70	10	6
HMS 6100-3000		30		80	10	
HMS 6100-4600		46		100	10	
HMS 6120-2600	12	26	-	75	12	6
HMS 6120-3600		36		100	12	
HMS 6120-5600		56		120	12	

Milling Conditions for HMS

◆Short length of cut

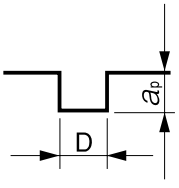
WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS (40~50HRC)					HARDENED STEELS (50~60HRC)					HARDENED STEELS (60~65HRC)				
Model Number	Number of Flute	Outside Diameter (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Slotting	Side Milling		Spindle Speed (min^{-1})	Feed Rate (mm/min)	Slotting	Side Milling		Spindle Speed (min^{-1})	Feed Rate (mm/min)	Slotting	Side Milling	
					a_p (mm)	a_p (mm)	a_e (mm)			a_p (mm)	a_p (mm)	a_e (mm)			a_p (mm)	a_p (mm)	a_e (mm)
3010-0250	**3**	1	9,500	140	0.05	1	0.05	6,400	95	0.05	1	0.05	6,400	90	0.05	1	0.05
3015-0400		1.5	6,400	100	0.075	1.5	0.075	4,200	60	0.075	1.5	0.075	4,200	60	0.075	1.5	0.075
3020-0400		2	4,700	80	0.1	2	0.1	3,200	75	0.1	2	0.1	3,200	70	0.1	2	0.1
3030-0600		3	3,200	85	0.15	3	0.15	2,100	80	0.15	3	0.15	2,100	80	0.15	3	0.15
4040-0800	**4**	4	2,400	90	0.2	4	0.2	1,600	85	0.2	4	0.2	1,600	80	0.2	4	0.2
4050-1000		5	1,900	90	0.25	5	0.25	1,300	85	0.25	5	0.25	1,300	80	0.25	5	0.25
6060-1300	**6**	6	1,600	170	0.3	6	0.3	1,100	120	0.3	6	0.3	1,100	110	0.3	6	0.3
6080-1900		8	1,200	170	0.4	8	0.4	800	120	0.4	8	0.4	800	110	0.4	8	0.4
6100-2200		10	950	170	0.5	15	0.5	640	100	0.5	15	0.5	640	80	0.5	15	0.5
6120-2600		12	800	170	0.5	18	0.5	530	90	0.5	18	0.5	530	70	0.5	18	0.5
Milling Amount (mm)		Slotting	$a_p \leq$ 0.05D (max 0.5 mm)														
		Side Milling	D≤Ø 8 a_p=1D D≥Ø 10 a_p=1.5D $a_e \leq$ 0.05D (max 0.5 mm)														

◆High speed milling for short length of cut

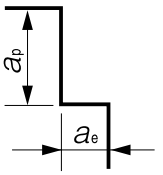
WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS (40~50HRC)				HARDENED STEELS (50~60HRC)				HARDENED STEELS (60~65HRC)			
Model Number	Number of Flute	Outside Diameter (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Side Milling		Spindle Speed (min^{-1})	Feed Rate (mm/min)	Side Milling		Spindle Speed (min^{-1})	Feed Rate (mm/min)	Side Milling	
					a_p (mm)	a_e (mm)			a_p (mm)	a_e (mm)			a_p (mm)	a_e (mm)
3010-0250	**3**	1	22,500	630	1.5	0.03	20,000	540	1.5	0.02	15,000	450	0.5	0.01
3015-0400		1.5	18,000	720	2.25	0.045	16,000	630	2.25	0.03	11,500	540	0.75	0.015
3020-0400		2	14,300	850	3	0.06	13,000	750	3	0.04	8,500	630	1	0.02
3030-0600		3	13,100	1,120	4.5	0.09	11,200	950	4.5	0.06	6,700	760	1.5	0.03
4040-0800	**4**	4	11,300	1,300	6	0.12	9,900	1,170	6	0.08	2,850	630	8	0.08
4050-1000		5	10,100	1,530	7.5	0.15	8,900	1,350	7.5	0.1	2,400	700	10	0.1
6060-1300	**6**	6	8,900	1,950	9	0.18	8,000	1,800	9	0.12	2,150	830	12	0.12
6080-1900		8	7,700	2,350	12	0.24	6,900	2,200	12	0.16	2,100	900	16	0.16
6100-2200		10	6,700	3,100	15	0.3	6,000	2,700	15	0.2	2,000	1,000	20	0.2
6120-2600		12	5,800	3,000	18	0.36	5,300	2,500	18	0.24	1,950	1,070	24	0.24
Milling Amount (mm)		Side Milling	a_p=1.5D a_e=0.03D (max 0.5 mm)				a_p=1.5D a_e=0.02D				D≤Ø 3 D≥Ø 4		a_p=0.5D a_e=0.01D a_p=2D a_e=0.02D	

D : Outside Diamater (mm)
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

Slotting



Side Milling



Milling Conditions for HMS

◆Medium length of cut

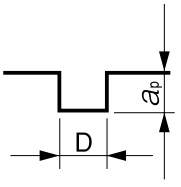
WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS (40~50HRC)					HARDENED STEELS (50~60HRC)					HARDENED STEELS (60~65HRC)				
Model Number	Number of Flute	Outside Diameter (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Slotting	Side Milling		Spindle Speed (min^{-1})	Feed Rate (mm/min)	Slotting	Side Milling		Spindle Speed (min^{-1})	Feed Rate (mm/min)	Slotting	Side Milling	
					a_p (mm)	a_p (mm)	a_e (mm)			a_p (mm)	a_p (mm)	a_e (mm)			a_p (mm)	a_p (mm)	a_e (mm)
3030-1000	**3**	3	3,200	43~85	0.09	6	0.09	2,100	40~80	0.09	6	0.09	2,100	40~80	0.09	6	0.09
4040-1200	**4**	4	2,400	45~90	0.12	8	0.12	1,600	43~85	0.12	8	0.12	1,600	40~80	0.12	8	0.12
4050-1500		5	1,900	45~90	0.15	10	0.15	1,300	43~85	0.15	10	0.15	1,300	40~80	0.15	10	0.15
6060-1800	**6**	6	1,600	85~170	0.18	12	0.18	1,100	60~120	0.18	12	0.18	1,100	55~110	0.18	12	0.18
6080-2400		8	1,200	85~170	0.24	16	0.24	800	60~120	0.24	16	0.24	800	55~110	0.24	16	0.24
6100-3000		10	950	85~170	0.3	25	0.3	640	50~100	0.3	25	0.3	640	40~80	0.3	25	0.3
6120-3600		12	800	85~170	0.3	30	0.3	530	45~90	0.3	30	0.3	530	35~70	0.3	30	0.3
Milling Amount (mm)		Slotting	$a_p \leq$ 0.03D (max 0.3 mm)														
		Side Milling	D≤Ø 8 a_p=2D D≥Ø 10 a_p=2.5D $a_e \leq$ 0.03D (max 0.3 mm)														

◆Long length of cut

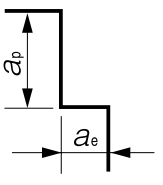
WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS (40~50HRC)				HARDENED STEELS (50~60HRC)				HARDENED STEELS (60~65HRC)			
Model Number	Number of Flute	Outside Diameter (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Side Milling		Spindle Speed (min^{-1})	Feed Rate (mm/min)	Side Milling		Spindle Speed (min^{-1})	Feed Rate (mm/min)	Side Milling	
					a_p (mm)	a_e (mm)			a_p (mm)	a_e (mm)			a_p (mm)	a_e (mm)
3010-0350	**3**	1	9,500	140~210	3	0.02	6,400	95~143	3	0.02	6,400	95~133	3	0.02
3015-0600		1.5	6,300	100~150	4.5	0.03	4,200	80~120	4.5	0.03	4,200	80~112	4.5	0.03
3020-0700		2	4,700	80~120	6	0.04	3,200	75~113	6	0.04	3,200	75~113	6	0.04
3030-1500		3	3,200	85~128	9	0.06	2,100	80~120	9	0.06	2,100	80~120	9	0.06
4040-2000	**4**	4	2,400	90~135	12	0.08	1,600	85~128	12	0.08	1,600	83~125	12	0.08
4050-2500		5	1,900	90~135	15	0.1	1,300	85~128	15	0.1	1,300	83~125	15	0.1
6060-2600	**6**	6	1,600	170~255	18	0.12	1,100	120~180	18	0.12	1,100	112~168	18	0.12
6080-3600		8	1,200	170~255	24	0.16	800	120~180	24	0.16	800	110~166	24	0.16
6100-4600		10	950	170~255	30	0.2	640	100~150	30	0.2	640	88~132	30	0.2
6120-5600		12	800	170~255	36	0.24	530	90~135	36	0.24	530	76~114	36	0.24
Milling Amount (mm)		Side Milling					a_p=3D $a_e \leq$ 0.02D							

D : Outside Diamater (mm)
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

Slotting



Side Milling



Note:
・Recommend down cut processing.
・Reduce cutting amount, feed rate, and apply zero-cut in accordance with required surface quality.
・Recommend air blow or oil mist.

4 Flutes UTCOAT

Size Ø1~Ø12

CXS

Super MG | UT COAT | 37°~40° | Flatland | Shank Dia 0/-0.005 | Variable Pitch | Variable Helix

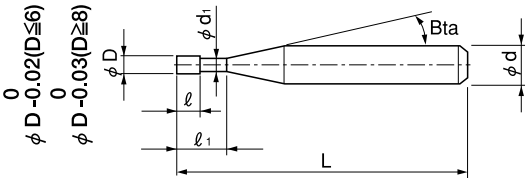
Additional 11 models

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	○			○			◎			○	○		

Features

Variable Division & Helix design minimizes vibration and chattering.
Selected high toughness and chip resistant carbide material.
Optimized flute design offers outstanding high efficiency milling and fine finishing.
Low friction coating resulting in excellent chip evacuation and resistance to wear.



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 33 models

Unit（mm）

	Model Number	Outside Diameter ØD	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles 30'	1°	1°30'	2°	3°
	CXS4010-030	1	3	1.5	0.96	16°	50	4	3.25	3.35	3.47	3.59	3.86
※	CXS4010-050		5				70	4	5.31	5.48	5.67	5.87	6.31
	CXS4010-060		6				70	4	6.34	6.55	6.77	7.00	7.53
	CXS4015-045	1.5	4.5	2.25	1.46	16°	50	4	4.66	4.81	4.97	5.15	5.53
※	CXS4015-070		7				70	4	7.23	7.47	7.72	7.99	8.59
	CXS4015-085		8.5				70	4	8.78	9.07	9.37	9.70	10.43
	CXS4020-060	2	6	3	1.94	16°	50	4	6.24	6.44	6.66	6.89	7.41
※	CXS4020-090		9				70	4	9.33	9.64	9.96	10.31	11.08
	CXS4020-110		11				70	4	11.40	11.77	12.16	12.59	13.53
	CXS4025-075	2.5	7.5	3.75	2.44	16°	50	4	7.79	8.04	8.31	8.60	9.25
※	CXS4025-110		11				70	4	11.40	11.77	12.16	12.59	13.53
	CXS4025-135		13.5				70	4	13.97	14.43	14.91	15.43	No Interference

※Additional model

Next Page ➡

Unit（mm）

	Model Number	Outside Diameter ØD	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
									30'	1°	1°30'	2°	3°
	CXS4030-090	3	9	4.5	2.95	16°	50	6	9.34	9.64	9.97	10.31	11.09
※	CXS4030-130		13				70	6	13.46	13.90	14.37	14.87	15.98
	CXS4030-160		16				70	6	16.56	17.10	17.67	18.28	19.65
	CXS4040-120	4	12	6	3.86	16°	50	6	12.61	13.02	13.46	13.92	14.97
※	CXS4040-170		17				70	6	17.76	18.34	18.96	19.62	No Interference
	CXS4040-210		21				70	6	21.89	22.60	23.36	24.17	No Interference
	CXS4050-150	5	15	7.5	4.86	16°	50	6	15.70	16.21	16.76	No Interference	No Interference
※	CXS4050-210		21				70	6	21.89	22.60	No Interference	No Interference	No Interference
	CXS4050-260		26				70	6	27.05	27.93	No Interference	No Interference	No Interference
	CXS4060-180	6	18	9	5.86	-	50	6	No Interference	No Interference	No Interference	No Interference	No Interference
※	CXS4060-260		26				70	6	No Interference	No Interference	No Interference	No Interference	No Interference
	CXS4060-320		32				70	6	No Interference	No Interference	No Interference	No Interference	No Interference
	CXS4080-240	8	24	12	7.82	-	60	8	No Interference	No Interference	No Interference	No Interference	No Interference
※	CXS4080-340		34				90	8	No Interference	No Interference	No Interference	No Interference	No Interference
	CXS4080-420		42				90	8	No Interference	No Interference	No Interference	No Interference	No Interference
	CXS4100-300	10	30	15	9.82	-	70	10	No Interference	No Interference	No Interference	No Interference	No Interference
※	CXS4100-420		42				100	10	No Interference	No Interference	No Interference	No Interference	No Interference
	CXS4100-520		52				100	10	No Interference	No Interference	No Interference	No Interference	No Interference
	CXS4120-360	12	36	18	11.82	-	90	12	No Interference	No Interference	No Interference	No Interference	No Interference
※	CXS4120-520		52				110	12	No Interference	No Interference	No Interference	No Interference	No Interference
	CXS4120-620		62				110	12	No Interference	No Interference	No Interference	No Interference	No Interference

※Additional model

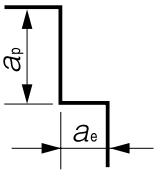
Milling Conditions for CXS

Side Milling

WORK MATERIAL			CARBON STEELS S45C / S50C Annealed Materials (~225HB)				ALLOY STEELS SK / SCM Annealed Materials (225~325HB)				STAINLESS STEELS SUS304 Use water soluble or oil coolant.			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-030		3	18,000	780	1	0.3	18,000	600	1	0.3	14,500	400	1	0.3
4010-050	**1**	5	18,000	780	1	0.23	15,330	520	1	0.23	12,570	350	1	0.23
4010-060		6	18,000	780	1	0.2	14,000	480	1	0.2	11,600	320	1	0.2
4015-045		4.5	13,500	970	1.5	0.45	13,500	750	1.5	0.45	13,300	420	1.5	0.45
4015-070	**1.5**	7	13,500	970	1.5	0.36	11,810	660	1.5	0.36	11,610	360	1.5	0.36
4015-085		8.5	13,500	970	1.5	0.3	10,800	600	1.5	0.3	10,600	330	1.5	0.3
4020-060		6	11,000	1,170	2	0.6	11,000	900	2	0.6	12,200	450	2	0.6
4020-090	**2**	9	11,000	1,170	2	0.48	9,680	790	2	0.48	10,730	400	2	0.48
4020-110		11	11,000	1,170	2	0.4	8,800	720	2	0.4	9,750	360	2	0.4
4025-075		7.5	9,500	1,180	2.5	0.75	9,500	900	2.5	0.75	11,000	550	2.5	0.75
4025-110	**2.5**	11	9,500	1,180	2.5	0.6	8,390	800	2.5	0.6	9,720	490	2.5	0.6
4025-135		13.5	9,500	1,180	2.5	0.5	7,600	720	2.5	0.5	8,800	440	2.5	0.5
4030-090		9	8,500	1,200	3	0.9	8,500	900	3	0.9	10,000	640	3	0.9
4030-130	**3**	13	8,500	1,200	3	0.73	7,530	800	3	0.73	8,860	570	3	0.73
4030-160		16	8,500	1,200	3	0.6	6,800	720	3	0.6	8,000	510	3	0.6
4040-120		12	7,200	1,350	4	1.2	6,700	1,000	4	1.2	7,500	730	4	1.2
4040-170	**4**	17	7,200	1,350	4	0.98	5,920	890	4	0.98	6,670	650	4	0.98
4040-210		21	7,200	1,350	4	0.8	5,300	800	4	0.8	6,000	580	4	0.8
4050-150		15	6,000	1,500	5	1.5	5,400	1,100	5	1.5	5,400	810	5	1.5
4050-210	**5**	21	6,000	1,500	5	1.23	4,800	980	5	1.23	4,800	720	5	1.23
4050-260		26	6,000	1,500	5	1	4,300	880	5	1	4,300	640	5	1
4060-180		18	5,000	1,600	6	1.8	4,500	1,200	6	1.8	4,500	810	6	1.8
4060-260	**6**	26	5,000	1,600	6	1.46	3,990	1,060	6	1.46	3,990	710	6	1.46
4060-320		32	5,000	1,600	6	1.2	3,600	960	6	1.2	3,600	640	6	1.2
4080-240		24	3,000	1,300	8	2.4	2,900	1,050	8	2.4	2,900	720	8	2.4
4080-340	**8**	34	3,000	1,300	8	1.96	2,570	930	8	1.96	2,570	640	8	1.96
4080-420		42	3,000	1,300	8	1.6	2,300	840	8	1.6	2,300	570	8	1.6
4100-300		30	1,600	1,000	10	3	1,500	900	10	3	1,500	580	10	3
4100-420	**10**	42	1,600	1,000	10	2.45	1,340	800	10	2.45	1,340	510	10	2.45
4100-520		52	1,600	1,000	10	2	1,200	720	10	2	1,200	460	10	2
4120-360		36	1,200	800	12	3.6	1,200	750	12	3.6	1,200	540	12	3.6
4120-520	**12**	52	1,200	800	12	2.86	1,050	660	12	2.86	1,050	470	12	2.86
4120-620		62	1,200	800	12	2.4	950	600	12	2.4	950	430	12	2.4

Milling Conditions for CXS

WORK MATERIAL			PREHARDENED STEELS HPM / NAK (30～45HRC)				HARDENED STEELS SKD / SKT / STAVAX (45～55HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-030	**1**	3	12,900	400	1	0.3	12,900	180	1	0.15
4010-050		5	11,170	350	1	0.23	12,900	180	1	0.12
4010-060		6	10,300	320	1	0.2	12,900	180	1	0.1
4015-045	**1.5**	4.5	10,500	500	1.5	0.45	9,500	280	1.5	0.225
4015-070		7	9,190	440	1.5	0.36	9,500	280	1.5	0.18
4015-085		8.5	8,400	400	1.5	0.3	9,500	280	1.5	0.15
4020-060	**2**	6	9,350	560	2	0.6	8,200	390	2	0.3
4020-090		9	8,210	490	2	0.48	8,200	390	2	0.24
4020-110		11	7,450	440	2	0.4	8,200	390	2	0.2
4025-075	**2.5**	7.5	8,300	610	2.5	0.75	7,800	510	2.5	0.375
4025-110		11	7,340	530	2.5	0.6	7,800	510	2.5	0.3
4025-135		13.5	6,650	480	2.5	0.5	7,800	510	2.5	0.25
4030-090	**3**	9	7,400	630	3	0.9	7,400	630	3	0.45
4030-130		13	6,540	560	3	0.73	7,400	630	3	0.36
4030-160		16	5,900	500	3	0.6	7,400	630	3	0.3
4040-120	**4**	12	5,900	650	4	1.2	5,900	650	4	0.6
4040-170		17	5,230	580	4	0.98	5,900	650	4	0.49
4040-210		21	4,700	520	4	0.8	5,900	650	4	0.4
4050-150	**5**	15	4,800	680	5	1.5	4,800	670	5	0.75
4050-210		21	4,250	600	5	1.23	4,800	670	5	0.61
4050-260		26	3,800	540	5	1	4,800	670	5	0.5
4060-180	**6**	18	4,000	680	6	1.8	4,000	680	6	0.9
4060-260		26	3,540	600	6	1.46	4,000	680	6	0.73
4060-320		32	3,200	540	6	1.2	4,000	680	6	0.6
4080-240	**8**	24	2,500	600	8	2.4	2,500	630	8	1.2
4080-340		34	2,220	530	8	1.96	2,500	630	8	0.98
4080-420		42	2,000	480	8	1.6	2,500	630	8	0.8
4100-300	**10**	30	1,500	430	10	3	1,500	570	10	1.5
4100-420		42	1,340	380	10	2.45	1,500	570	10	1.23
4100-520		52	1,200	340	10	2	1,500	570	10	1
4120-360	**12**	36	1,000	320	12	3.6	1,200	530	12	1.8
4120-520		52	880	280	12	2.86	1,200	500	12	1.43
4120-620		62	800	250	12	2.4	1,200	480	12	1.2



Side Milling
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

Milling Conditions for CXS

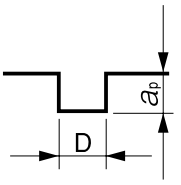
Slotting

WORK MATERIAL			CARBON STEELS S45C / S50C Annealed Materials (~225HB)			ALLOY STEELS SK / SCM Annealed Materials (225~325HB)			STAINLESS STEELS SUS304 Use water soluble or oil coolant.		
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)
4010-030	**1**	3	18,000	300	1	18,000	300	1	14,500	280	0.5
4010-050		5	18,000	300	0.67	15,330	260	0.67	12,570	240	0.37
4010-060		6	18,000	300	0.5	14,000	240	0.5	11,600	220	0.3
4015-045	**1.5**	4.5	13,500	450	1.5	13,500	400	1.5	13,300	300	0.75
4015-070		7	13,500	450	1.03	11,810	350	1.03	11,610	260	0.56
4015-085		8.5	13,500	450	0.75	10,800	320	0.75	10,600	240	0.45
4020-060	**2**	6	11,000	600	2	11,000	400	2	12,200	320	1
4020-090		9	11,000	600	1.4	9,680	350	1.4	10,730	280	0.76
4020-110		11	11,000	600	1	8,800	320	1	9,750	250	0.6
4025-075	**2.5**	7.5	9,500	600	2.5	9,500	400	2.5	11,000	340	1.25
4025-110		11	9,500	600	1.77	8,390	350	1.77	9,720	300	0.96
4025-135		13.5	9,500	600	1.25	7,600	320	1.25	8,800	270	0.75
4030-090	**3**	9	8,500	600	3	8,500	400	3	10,000	360	1.5
4030-130		13	8,500	600	2.57	7,530	350	2.14	8,860	310	1.16
4030-160		16	8,500	600	2.25	6,800	320	1.5	8,000	280	0.9
4040-120	**4**	12	7,200	650	4	6,700	450	4	7,500	400	2
4040-170		17	7,200	650	3.44	5,920	400	2.89	6,670	360	1.56
4040-210		21	7,200	650	3	5,300	360	2	6,000	320	1.2
4050-150	**5**	15	6,000	700	5	5,400	500	5	5,400	460	2.5
4050-210		21	6,000	700	4.32	4,800	450	3.64	4,800	410	1.95
4050-260		26	6,000	700	3.75	4,300	400	2.5	4,300	360	1.5
4060-180	**6**	18	5,000	700	6	4,500	500	6	4,500	460	3
4060-260		26	5,000	700	5.14	3,990	440	4.29	3,990	400	2.31
4060-320		32	5,000	700	4.5	3,600	400	3	3,600	360	1.8
4080-240	**8**	24	3,000	500	8	2,900	360	8	2,900	360	4
4080-340		34	3,000	500	6.89	2,570	320	5.78	2,570	320	3.11
4080-420		42	3,000	500	6	2,300	280	4	2,300	280	2.4
4100-300	**10**	30	1,600	380	10	1,500	270	10	1,500	220	5
4100-420		42	1,600	380	8.64	1,340	240	7.27	1,340	190	3.91
4100-520		52	1,600	380	7.5	1,200	210	5	1,200	170	3
4120-360	**12**	36	1,200	300	12	1,200	210	12	1,200	180	6
4120-520		52	1,200	300	10.15	1,050	180	8.31	1,050	160	4.52
4120-620		62	1,200	300	9	950	160	6	950	140	3.6

Milling Conditions for CXS

WORK MATERIAL			PREHARDENED STEELS HPM / NAK (30~45HRC)			HARDENED STEELS SKD / SKT / STAVAX (45~55HRC)		
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)
4010-030	**1**	3	12,900	170	1	12,900	60	0.25
4010-050		5	11,170	140	0.67	setting disable	setting disable	setting disable
4010-060		6	10,300	130	0.5	setting disable	setting disable	setting disable
4015-045	**1.5**	4.5	10,500	230	1.5	9,500	120	0.375
4015-070		7	9,190	200	1.03	setting disable	setting disable	setting disable
4015-085		8.5	8,400	180	0.75	setting disable	setting disable	setting disable
4020-060	**2**	6	9,350	280	2	8,200	180	0.5
4020-090		9	8,210	240	1.4	setting disable	setting disable	setting disable
4020-110		11	7,450	220	1	setting disable	setting disable	setting disable
4025-075	**2.5**	7.5	8,300	300	2.5	7,800	270	0.625
4025-110		11	7,340	270	1.77	setting disable	setting disable	setting disable
4025-135		13.5	6,650	240	1.25	setting disable	setting disable	setting disable
4030-090	**3**	9	7,400	320	3	7,400	360	1.5
4030-130		13	6,540	280	2.14	setting disable	setting disable	setting disable
4030-160		16	5,900	250	1.5	setting disable	setting disable	setting disable
4040-120	**4**	12	5,900	390	4	5,900	380	2
4040-170		17	5,230	350	2.89	setting disable	setting disable	setting disable
4040-210		21	4,700	310	2	setting disable	setting disable	setting disable
4050-150	**5**	15	4,800	440	5	4,800	410	2.5
4050-210		21	4,250	390	3.64	setting disable	setting disable	setting disable
4050-260		26	3,800	350	2.5	setting disable	setting disable	setting disable
4060-180	**6**	18	4,000	440	6	4,000	440	3
4060-260		26	3,540	390	4.29	setting disable	setting disable	setting disable
4060-320		32	3,200	350	3	setting disable	setting disable	setting disable
4080-240	**8**	24	2,500	390	8	2,500	340	4
4080-340		34	2,220	350	5.78	setting disable	setting disable	setting disable
4080-420		42	2,000	310	4	setting disable	setting disable	setting disable
4100-300	**10**	30	1,500	220	10	1,500	240	5
4100-420		42	1,340	190	7.27	setting disable	setting disable	setting disable
4100-520		52	1,200	170	5	setting disable	setting disable	setting disable
4120-360	**12**	36	1,000	180	12	1,200	220	6
4120-520		52	880	160	8.31	setting disable	setting disable	setting disable
4120-620		62	800	140	6	setting disable	setting disable	setting disable

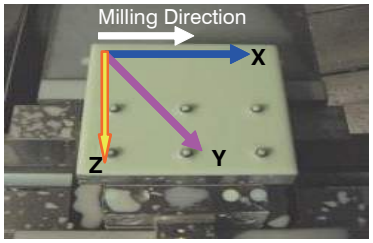
Contact our sales when milling hardened steels with L/D=5 or longer effective length tools.



Slotting
a_p : Axial Depth (mm)
D : Outside Diameter (mm)

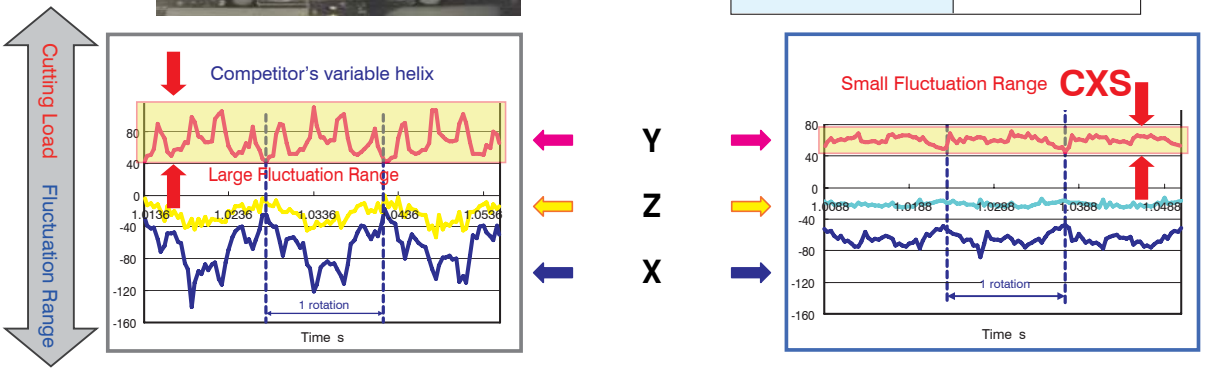
Note:
・Decrease both spindle speed and feed rate proportionally in case of chattering.
・These milling parameters are calculated based on the shortest overhang length.
Longer overhangs may require an adjustment to the milling parameters.
・Reduce the milling amount and feed rate in accordance with required milling precision.
・Every coolant offers stable milling.
・Recommend water soluble or oil coolant for Stainless Steels and Copper.

Cutting Load Comparison xCXS Ø8 SKD61 (50HRC)



◆Milling Conditions

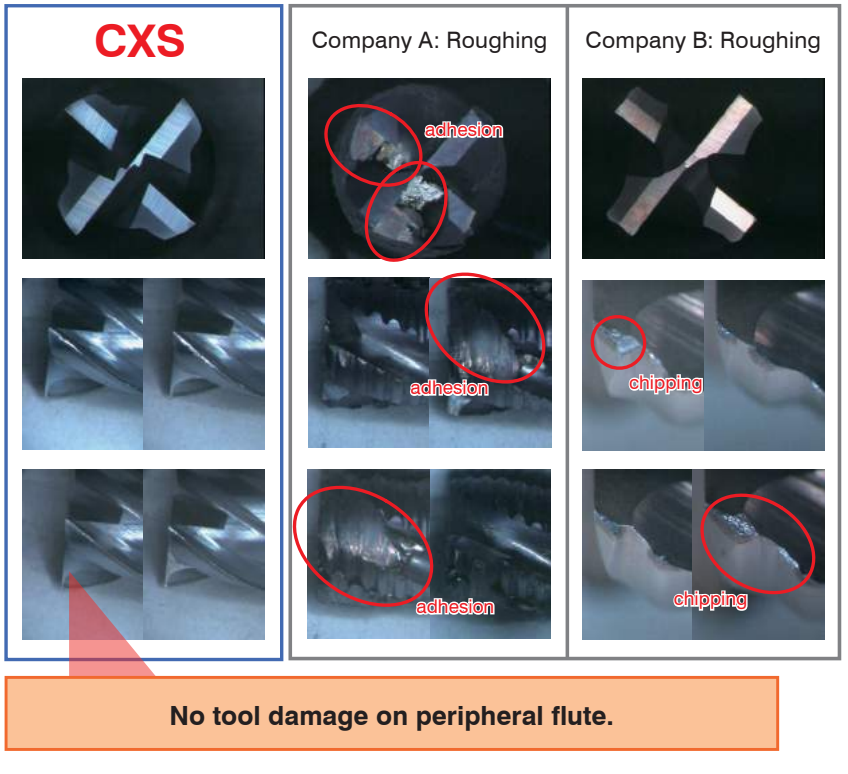
Spindle Speed	4,200 min^{-1}
Feed Rate	**770 mm/min**
a_p Axial Depth	8 mm
a_e Radial Depth	**0.3 mm**
Coolant	Water Soluble



Tool damage and surface quality will be influenced by the cutting load fluctuation range.

CXS has a small fluctuation range and the tool is hard to chatter.

High Efficiency Milling Example CXS Ø8 SUS304



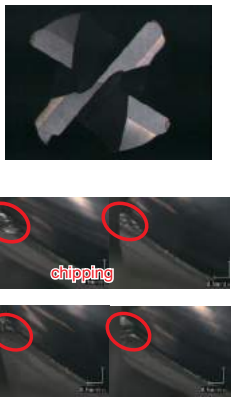
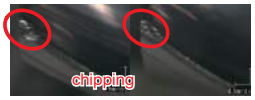
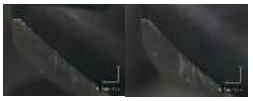
No tool damage on peripheral flute.

◆Milling Conditions

Spindle Speed	5,000 min^{-1}
Feed Rate	**600 mm/min**
a_p Axial Depth	8 mm
a_e Radial Depth	**3 mm**
Coolant	Water Soluble
Milling Distance	5.4 m

※Using company B's milling condition

Milling Example by Different Work Materials ① CXS Ø8 SKD61 (50HRC)

CXS	Company A: Variable Helix	Company B: Variable Helix
		
		
		
Milling Distance **77 m**	**Milling Distance** **44 m**	**Milling Distance** **22 m**

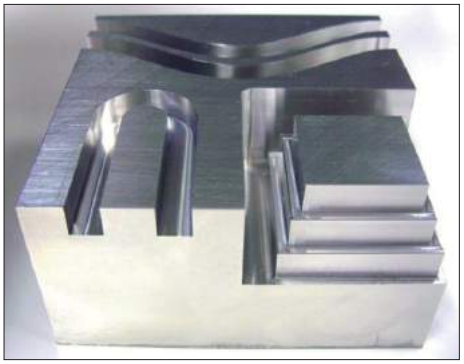
Designed for a heavy roughing cut, even up to 50HRC

◆Milling Conditions

Spindle Speed	4,200 min^{-1}
Feed Rate	**770 mm/min**
a_p Axial Depth	8 mm
a_e Radial Depth	**1 mm**
Coolant	Water Soluble

※Using company B's milling condition

Milling Example by Different Work Materials ② CXS Ø8 SUS304



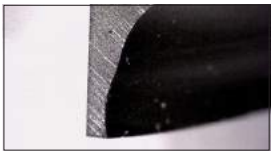
Size : 100 × 100 × 50 mm

◆Milling Conditions

Milling Method	Side milling, Slotting (One direction)
Spindle Speed	2,900 min^{-1}
Feed Rate	360 mm/min (Slotting) 720 mm/min (Side milling)
a_p Axial Depth	**8 mm (1D)**
a_e Radial Depth	2.4 mm
Coolant	Water Soluble
Cycle Time	**5 min**

High efficiency milling of difficult-to-cut material (SUS304).

◆Tool after Milling

Flatland	Tool tip relief surface	**8 mm from tip point (ap : 8 mm)**
		

Excellent tool life for high efficiency milling and finishing process.

CXS Series SUS304 Milling Video

Size Ø0.1~Ø6

HLS2000

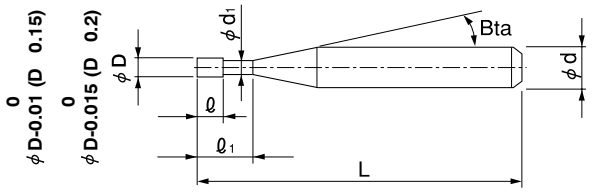
Super MG | HARD MAX | 30° | Flatland | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

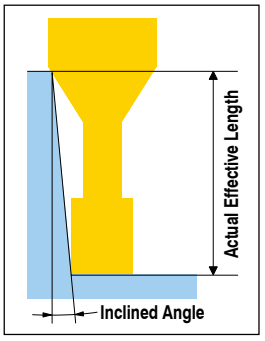
Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
○	○	◎	◎	○		○			○			○	○		

Features

New HARDMAX coating and optimized tool design control tool chipping. Longer tool life with deep rib milling on hard materials.
High Accuracy: Diameter Tolerance: 0/-0.01 (D 0.15)、0/-0.015 (D 0.2)
Longer tool life with HARDMAX.
Refer to page 254 for 4 flute HLS.



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.



Total 184 models Unit (mm)

Model Number	Outside Diameter ØD	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles 30'	1°	1°30'	2°	3°
HLS 2001-003	0.1	0.3	0.1	0.088	11°	45	4	0.33	0.36	0.38	0.40	0.45
HLS 2001-005		0.5				45	4	0.54	0.58	0.61	0.64	0.69
HLS 20015-005	0.15	0.5	0.15	0.128	11°	45	4	0.58	0.61	0.63	0.66	0.71
HLS 20015-007		0.75				45	4	0.84	0.88	0.91	0.94	1.02
HLS 20015-010		1				45	4	1.10	1.14	1.18	1.23	1.32
HLS 2002-005	0.2	0.5	0.3	0.18	16°	45	4	0.65	0.70	0.74	0.78	0.85
HLS 2002-010		1				45	4	1.18	1.25	1.31	1.36	1.45
HLS 2002-015		1.5				45	4	1.67	1.76	1.84	1.90	2.01

Next Page ➡

Unit（mm）

Model Number	Outside Diameter ØD	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
HLS 2003-010	0.3	1	0.4	0.28	16°	45	4	1.22	1.30	1.37	1.43	1.55
HLS 2003-015		1.5				45	4	1.71	1.82	1.91	1.98	2.12
HLS 2003-020		2				45	4	2.24	2.36	2.46	2.55	2.70
HLS 2003-025		2.5				45	4	2.77	2.91	3.02	3.11	3.27
HLS 2003-030		3				45	4	3.30	3.45	3.56	3.66	3.83
HLS 2003-040		4				45	4	4.35	4.51	4.64	4.75	4.94
HLS 2003-060		6				45	4	6.43	6.63	6.78	6.91	7.12
HLS 2003-090		9				45	4	9.53	9.76	9.94	10.09	10.32
HLS 2004-015	0.4	1.5	0.6	0.38	16°	45	4	1.77	1.91	2.03	2.13	2.31
HLS 2004-020		2				45	4	2.31	2.47	2.60	2.71	2.91
HLS 2004-025		2.5				45	4	2.85	3.02	3.16	3.28	3.49
HLS 2004-030		3				45	4	3.38	3.57	3.72	3.85	4.07
HLS 2004-035		3.5				45	4	3.91	4.11	4.27	4.41	4.64
HLS 2004-040		4				45	4	4.44	4.65	4.82	4.96	5.21
HLS 2004-050		5				45	4	5.49	5.73	5.91	6.06	6.33
HLS 2004-080		8				45	4	8.63	8.91	9.13	9.31	9.62
HLS 2004-120		12				45	4	12.77	13.10	13.36	13.57	13.91
HLS 2005-015	0.5	1.5	0.7	0.48	16°	45	4	1.83	1.99	2.13	2.25	2.48
HLS 2005-020		2				45	4	2.37	2.56	2.71	2.85	3.09
HLS 2005-025		2.5				45	4	2.92	3.12	3.29	3.43	3.69
HLS 2005-030		3				45	4	3.45	3.68	3.85	4.01	4.28
HLS 2005-040		4				45	4	4.52	4.77	4.97	5.14	5.44
HLS 2005-050		5				45	4	5.58	5.86	6.08	6.26	6.58
HLS 2005-060		6				45	4	6.64	6.94	7.17	7.37	7.71
HLS 2005-080		8				45	4	8.74	9.07	9.33	9.56	9.93
HLS 2005-100		10				50	4	10.82	11.19	11.48	11.72	12.12
HLS 2005-150		15				50	4	16.00	16.44	16.78	17.05	17.50
HLS 2006-020	0.6	2	0.9	0.58	16°	45	4	2.39	2.62	2.80	2.96	3.24
HLS 2006-030		3				45	4	3.49	3.75	3.96	4.14	4.32
HLS 2006-040		4				45	4	4.57	4.86	5.09	5.29	5.69
HLS 2006-050		5				45	4	5.64	5.96	6.21	6.43	6.92
HLS 2006-060		6				45	4	6.70	7.05	7.32	7.57	8.14
HLS 2006-070		7				45	4	7.76	8.13	8.42	8.71	9.36
HLS 2006-080		8				45	4	8.81	9.20	9.52	9.85	10.59
HLS 2006-100		10				45	4	10.91	11.34	11.72	12.13	13.04
HLS 2006-120		12				50	4	13.00	13.47	13.92	14.40	15.48
HLS 2006-180		18				50	4	19.23	19.85	20.52	21.24	22.82

Next Page ➡

2 Flutes HARDMAX

Unit（mm）

Model Number	Outside Diameter ØD	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
HLS 2007-020	0.7	2	1	0.68	16°	45	4	2.39	2.62	2.80	2.96	3.24
HLS 2007-040		4				45	4	4.57	4.86	5.09	5.29	5.69
HLS 2007-060		6				45	4	6.70	7.05	7.32	7.57	8.14
HLS 2007-080		8				45	4	8.81	9.20	9.52	9.85	10.59
HLS 2007-100		10				50	4	10.91	11.34	11.72	12.13	13.04
HLS 2008-030	0.8	3	1.2	0.78	16°	45	4	3.49	3.75	3.96	4.14	4.32
HLS 2008-040		4				45	4	4.57	4.86	5.09	5.29	5.69
HLS 2008-050		5				45	4	5.64	5.96	6.21	6.43	6.92
HLS 2008-060		6				45	4	6.70	7.05	7.32	7.57	8.14
HLS 2008-080		8				45	4	8.81	9.20	9.52	9.85	10.59
HLS 2008-100		10				50	4	10.91	11.34	11.72	12.13	13.04
HLS 2008-120		12				50	4	13.00	13.47	13.92	14.40	15.48
HLS 2008-160		16				50	4	17.16	17.73	18.32	18.96	20.38
HLS 2008-240		24				60	4	25.42	26.24	27.13	28.07	30.17
HLS 2009-040	0.9	4	1.3	0.88	16°	45	4	4.57	4.86	5.09	5.29	5.69
HLS 2009-060		6				45	4	6.70	7.05	7.32	7.57	8.14
HLS 2009-080		8				45	4	8.81	9.20	9.52	9.85	10.59
HLS 2009-100		10				45	4	10.91	11.34	11.72	12.13	13.04
HLS 2009-150		15				50	4	16.12	16.66	17.22	17.82	19.15
HLS 2010-030	1	3	1.5	0.95	16°	45	4	3.62	3.85	4.04	4.21	4.54
HLS 2010-040		4				45	4	4.69	4.95	5.16	5.36	5.76
HLS 2010-050		5				45	4	5.75	6.04	6.27	6.49	6.98
HLS 2010-060		6				45	4	6.80	7.12	7.38	7.63	8.21
HLS 2010-070		7				45	4	7.85	8.19	8.48	8.77	9.43
HLS 2010-080		8				45	4	8.90	9.26	9.58	9.91	10.65
HLS 2010-090		9				45	4	9.95	10.33	10.68	11.05	11.88
HLS 2010-100		10				45	4	10.99	11.39	11.78	12.19	13.10
HLS 2010-120		12				45	4	13.07	13.52	13.98	14.47	15.55
HLS 2010-140		14				45	4	15.15	15.65	16.18	16.74	18.00
HLS 2010-160		16				50	4	17.22	17.78	18.38	19.02	20.44
HLS 2010-200		20				55	4	21.35	22.04	22.78	23.57	25.34
HLS 2010-250		25				70	4	26.51	27.37	28.29	29.27	No Interference
HLS 2010-300		30				70	4	31.66	32.69	33.79	34.96	No Interference

Next Page ➡

Unit（mm）

Model Number	Outside Diameter ØD	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
HLS 2012-040	1.2	4	1.8	1.14	16°	45	4	4.13	4.27	4.41	4.57	4.91
HLS 2012-060		6				45	4	6.19	6.40	6.61	6.84	7.36
HLS 2012-080		8				45	4	8.26	8.52	8.81	9.12	9.80
HLS 2012-100		10				45	4	10.32	10.65	11.01	11.40	12.25
HLS 2012-120		12				45	4	12.38	12.78	13.21	13.67	14.70
HLS 2012-160		16				50	4	16.51	17.04	17.62	18.23	19.59
HLS 2012-200		20				60	4	20.63	21.30	22.02	22.78	24.49
HLS 2014-060	1.4	6	2.1	1.34	16°	45	4	6.19	6.40	6.61	6.84	7.36
HLS 2014-080		8				45	4	8.26	8.52	8.81	9.12	9.80
HLS 2014-100		10				45	4	10.32	10.65	11.01	11.40	12.25
HLS 2014-120		12				45	4	12.38	12.78	13.21	13.67	14.70
HLS 2014-140		14				45	4	14.44	14.91	15.42	15.95	17.15
HLS 2014-160		16				50	4	16.51	17.04	17.62	18.23	19.59
HLS 2014-220		22				55	4	22.69	23.43	24.22	25.06	No Interference
HLS 2015-040	1.5	4	2.3	1.44	16°	45	4	4.13	4.27	4.41	4.57	4.91
HLS 2015-060		6				45	4	6.19	6.40	6.61	6.84	7.36
HLS 2015-080		8				45	4	8.26	8.52	8.81	9.12	9.80
HLS 2015-100		10				45	4	10.32	10.65	11.01	11.40	12.25
HLS 2015-120		12				45	4	12.38	12.78	13.21	13.67	14.70
HLS 2015-140		14				50	4	14.44	14.91	15.42	15.95	17.15
HLS 2015-160		16				50	4	16.51	17.04	17.62	18.23	19.59
HLS 2015-180		18				55	4	18.57	19.17	19.82	20.51	22.04
HLS 2015-200		20				55	4	20.63	21.30	22.02	22.78	No Interference
HLS 2015-250		25				70	4	25.79	26.63	27.52	28.48	No Interference
HLS 2015-300		30				70	4	30.95	31.95	33.02	34.17	No Interference
HLS 2015-350		35				70	4	36.10	37.27	38.53	No Interference	No Interference
HLS 2015-400		40				80	4	41.26	42.60	44.03	No Interference	No Interference
HLS 2015-450		45				80	4	46.42	47.92	No Interference	No Interference	No Interference
HLS 2016-060	1.6	6	2.4	1.51	16°	45	4	6.23	6.43	6.65	6.88	7.40
HLS 2016-080		8				45	4	8.29	8.56	8.85	9.16	9.85
HLS 2016-100		10				45	4	10.35	10.69	11.05	11.43	12.29
HLS 2016-120		12				45	4	12.42	12.82	13.25	13.71	14.74
HLS 2016-140		14				50	4	14.48	14.95	15.45	15.99	17.19
HLS 2016-160		16				50	4	16.54	17.08	17.65	18.27	19.63
HLS 2016-180		18				55	4	18.60	19.21	19.85	20.54	22.08
HLS 2016-200		20				55	4	20.67	21.34	22.05	22.82	No Interference
HLS 2016-260		26				60	4	26.85	27.73	28.66	29.65	No Interference

Next Page ➡

2 Flutes HARDMAX

Unit（mm）

Model Number	Outside Diameter ØD	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
HLS 2018-060	1.8	6	2.7	1.71	16°	45	4	6.23	6.43	6.65	6.88	7.40
HLS 2018-080		8				45	4	8.29	8.56	8.85	9.16	9.85
HLS 2018-100		10				45	4	10.35	10.69	11.05	11.43	12.29
HLS 2018-120		12				45	4	12.42	12.82	13.25	13.71	14.74
HLS 2018-140		14				50	4	14.48	14.95	15.45	15.99	17.19
HLS 2018-160		16				50	4	16.54	17.08	17.65	18.27	19.63
HLS 2018-180		18				55	4	18.60	19.21	19.85	20.54	No Interference
HLS 2018-200		20				55	4	20.67	21.34	22.05	22.82	No Interference
HLS 2018-250		25				60	4	25.82	26.66	27.56	28.52	No Interference
HLS 2020-060	2	6	3	1.91	16°	45	4	6.23	6.43	6.65	6.88	7.40
HLS 2020-080		8				45	4	8.29	8.56	8.85	9.16	9.85
HLS 2020-100		10				45	4	10.35	10.69	11.05	11.44	12.29
HLS 2020-120		12				45	4	12.42	12.82	13.25	13.71	14.74
HLS 2020-140		14				50	4	14.48	14.95	15.45	15.99	17.19
HLS 2020-160		16				50	4	16.54	17.08	17.65	18.27	No Interference
HLS 2020-180		18				55	4	18.61	19.21	19.86	20.55	No Interference
HLS 2020-200		20				55	4	20.67	21.34	22.05	22.82	No Interference
HLS 2020-250		25				60	4	25.83	26.66	27.56	28.52	No Interference
HLS 2020-300		30				70	4	30.98	31.99	33.06	No Interference	No Interference
HLS 2020-350		35				80	4	36.14	37.31	38.56	No Interference	No Interference
HLS 2020-400		40				90	4	41.30	42.64	No Interference	No Interference	No Interference
HLS 2020-500		50				100	4	51.61	53.28	No Interference	No Interference	No Interference
HLS 2020-600		60				110	4	61.92	No Interference	No Interference	No Interference	No Interference
HLS 2025-080	2.5	8	3.7	2.41	16°	45	4	8.29	8.56	8.85	9.16	9.85
HLS 2025-100		10				45	4	10.35	10.69	11.05	11.44	12.29
HLS 2025-120		12				45	4	12.42	12.82	13.25	13.71	No Interference
HLS 2025-140		14				50	4	14.48	14.95	15.45	15.99	No Interference
HLS 2025-160		16				50	4	16.54	17.08	17.65	18.27	No Interference
HLS 2025-180		18				55	4	18.61	19.21	19.86	20.55	No Interference
HLS 2025-200		20				55	4	20.67	21.34	22.06	No Interference	No Interference
HLS 2025-250		25				60	4	25.83	26.66	27.56	No Interference	No Interference
HLS 2025-300		30				70	4	30.98	31.99	No Interference	No Interference	No Interference
HLS 2025-400		40				90	4	41.30	42.64	No Interference	No Interference	No Interference
HLS 2025-500		50				100	4	51.61	No Interference	No Interference	No Interference	No Interference

Next Page ➡

Unit（mm）

Model Number	Outside Diameter ØD	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
HLS 2030-080	3	8	4.5	2.92	16°	45	6	8.29	8.56	8.85	9.16	9.84
HLS 2030-100		10				45	6	10.35	10.69	11.05	11.43	12.29
HLS 2030-120		12				50	6	12.41	12.82	13.25	13.71	14.74
HLS 2030-140		14				50	6	14.48	14.95	15.45	15.99	17.18
HLS 2030-160		16				60	6	16.54	17.08	17.65	18.26	19.63
HLS 2030-180		18				60	6	18.60	19.21	19.85	20.54	22.08
HLS 2030-200		20				60	6	20.66	21.34	22.05	22.82	24.53
HLS 2030-250		25				70	6	25.82	26.66	27.56	28.51	No Interference
HLS 2030-300		30				80	6	30.98	31.98	33.06	34.21	No Interference
HLS 2030-350		35				80	6	36.14	37.31	38.56	39.90	No Interference
HLS 2030-400		40				90	6	41.29	42.63	44.06	No Interference	No Interference
HLS 2030-500		50				100	6	51.61	53.28	55.07	No Interference	No Interference
HLS 2040-120	4	12	6	3.82	16°	50	6	12.59	13.00	13.44	13.91	14.95
HLS 2040-160		16				60	6	16.72	17.26	17.84	18.46	No Interference
HLS 2040-200		20				60	6	20.84	21.52	22.24	23.02	No Interference
HLS 2040-250		25				70	6	26.00	26.85	27.75	28.71	No Interference
HLS 2040-300		30				70	6	31.16	32.17	33.25	No Interference	No Interference
HLS 2040-350		35				80	6	36.32	37.49	38.75	No Interference	No Interference
HLS 2040-400		40				90	6	41.47	42.82	No Interference	No Interference	No Interference
HLS 2040-450		45				90	6	46.63	48.14	No Interference	No Interference	No Interference
HLS 2040-500		50				100	6	51.79	53.47	No Interference	No Interference	No Interference
HLS 2040-600		60				110	6	62.10	No Interference	No Interference	No Interference	No Interference
HLS 2050-160	5	16	7.5	4.82	16°	60	6	16.72	17.26	17.84	No Interference	No Interference
HLS 2050-200		20				60	6	20.84	21.52	No Interference	No Interference	No Interference
HLS 2050-250		25				60	6	26.00	26.85	No Interference	No Interference	No Interference
HLS 2050-300		30				80	6	31.16	No Interference	No Interference	No Interference	No Interference
HLS 2050-350		35				80	6	36.32	No Interference	No Interference	No Interference	No Interference
HLS 2050-400		40				80	6	41.47	No Interference	No Interference	No Interference	No Interference
HLS 2050-500		50				110	6	51.79	No Interference	No Interference	No Interference	No Interference
HLS 2050-600		60				120	6	No Interference	No Interference	No Interference	No Interference	No Interference
HLS 2060-200	6	20	9	5.82		80	6	No Interference	No Interference	No Interference	No Interference	No Interference
HLS 2060-300		30				80	6	No Interference	No Interference	No Interference	No Interference	No Interference
HLS 2060-400		40				100	6	No Interference	No Interference	No Interference	No Interference	No Interference
HLS 2060-500		50				120	6	No Interference	No Interference	No Interference	No Interference	No Interference
HLS 2060-600		60				120	6	No Interference	No Interference	No Interference	No Interference	No Interference

Milling Conditions for HLS (2 Flutes)

WORK MATERIAL			CARBON STEELS S45C / S50C (~225HB)				ALLOY STEELS SK / SCM / SUS (225~325HB)				PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2001	**0.1**	0.3	30,000	30	0.003~0.005	0.035	30,000	15	0.002~0.005	0.035	30,000	16	0.001~0.004	0.035
		0.5	28,000	28	0.002~0.005	0.03	28,000	14	0.002~0.004	0.03	28,000	14	0.001~0.003	0.03
20015	**0.15**	0.5	30,000	90	0.004~0.007	0.07	30,000	80	0.003~0.006	0.07	30,000	70	0.003~0.005	0.07
		0.75	28,700	90	0.003~0.007	0.032	28,700	80	0.002~0.006	0.032	28,700	70	0.002~0.005	0.032
		1	27,300	80	0.002~0.006	0.015	27,300	70	0.001~0.005	0.015	27,300	60	0.001~0.004	0.015
2002	**0.2**	0.5	56,000	340	0.005~0.009	0.13	56,000	310	0.005~0.008	0.13	56,000	270	0.004~0.006	0.13
		1	50,900	290	0.003~0.007	0.035	50,900	260	0.003~0.006	0.035	50,900	230	0.002~0.004	0.035
		1.5	48,200	250	0.003~0.004	0.012	48,200	230	0.002~0.003	0.012	48,200	200	0.001~0.002	0.012
2003	**0.3**	1	60,000	560	0.009~0.015	0.101	60,000	500	0.008~0.013	0.101	60,000	440	0.006~0.01	0.101
		1.5	50,800	460	0.008~0.013	0.05	50,800	410	0.007~0.011	0.05	50,800	360	0.005~0.009	0.05
		2	41,500	350	0.006~0.01	0.023	41,500	320	0.005~0.009	0.023	41,500	280	0.004~0.007	0.023
		2.5	36,700	300	0.004~0.005	0.012	36,700	270	0.004~0.006	0.012	36,700	240	0.003~0.005	0.012
		3	31,900	240	0.002~0.004	0.008	31,900	220	0.002~0.003	0.008	31,900	190	0.001~0.002	0.008
		4	26,200	170	0.001~0.002	0.003	26,200	160	0.001~0.002	0.003	26,200	140	0.001~0.001	0.003
		6	20,400	100	0.001~0.001	-	20,400	90	0.001~0.001	-	20,400	80	0.001~0.001	-
		9	15,700	30	0.001~0.001	-	15,700	30	0.001~0.001	-	15,700	30	0.001~0.001	-
2004	**0.4**	1.5	52,700	660	0.011~0.016	0.095	57,700	640	0.009~0.015	0.095	48,100	470	0.007~0.012	0.095
		2	50,000	610	0.009~0.014	0.052	53,000	580	0.008~0.013	0.052	44,600	430	0.006~0.01	0.052
		2.5	47,300	560	0.007~0.012	0.026	48,300	520	0.007~0.011	0.026	41,100	390	0.005~0.008	0.026
		3	44,500	510	0.005~0.009	0.018	43,600	450	0.005~0.008	0.018	37,500	340	0.004~0.006	0.018
		3.5	42,800	480	0.005~0.008	0.01	40,800	410	0.004~0.009	0.01	35,300	310	0.004~0.005	0.01
		4	41,000	440	0.004~0.006	0.008	38,000	360	0.003~0.005	0.008	33,100	280	0.003~0.004	0.008
		5	38,500	380	0.003~0.004	0.004	34,200	300	0.002~0.004	0.004	30,100	240	0.002~0.003	0.004
		8	33,700	260	0.001~0.002	0.001	27,300	190	0.001~0.002	0.001	24,600	150	0.001~0.002	0.001
		12	30,000	140	0.001~0.001	-	22,500	100	0.001~0.001	-	20,700	80	0.001~0.001	-
2005	**0.5**	1.5	63,100	1,020	0.019~0.029	0.139	61,000	870	0.017~0.027	0.139	46,500	610	0.013~0.02	0.139
		2	56,800	900	0.015~0.025	0.098	54,000	760	0.014~0.023	0.098	40,600	510	0.011~0.018	0.098
		2.5	50,500	780	0.011~0.021	0.057	47,000	650	0.011~0.019	0.057	34,700	410	0.009~0.016	0.057
		3	44,200	660	0.007~0.016	0.037	39,900	530	0.008~0.015	0.037	32,200	370	0.007~0.011	0.037
		4	40,600	580	0.008~0.013	0.016	36,100	460	0.007~0.012	0.016	29,700	330	0.006~0.009	0.016
		5	37,000	500	0.006~0.01	0.008	32,300	390	0.006~0.009	0.008	27,200	290	0.005~0.007	0.008
		6	33,400	420	0.004~0.007	0.005	28,500	320	0.004~0.006	0.005	24,700	250	0.003~0.005	0.005
		8	29,100	320	0.002~0.003	0.002	24,100	240	0.002~0.003	0.002	21,600	190	0.001~0.003	0.002
		10	26,100	250	0.001~0.002	0.001	21,200	180	0.001~0.002	0.001	19,600	150	0.001~0.002	0.001
		15	21,500	120	0.001~0.001	-	16,700	80	0.001~0.001	-	16,300	70	0.001~0.001	-
2006	**0.6**	2	63,600	1,240	0.023~0.038	0.18	53,300	930	0.02 ~0.034	0.18	39,100	600	0.016~0.026	0.18
		3	52,500	990	0.018~0.03	0.075	44,000	740	0.016~0.026	0.075	33,500	500	0.013~0.02	0.075
		4	41,300	740	0.012~0.021	0.03	34,700	550	0.011~0.018	0.03	27,900	390	0.009~0.014	0.03
		5	36,700	630	0.01 ~0.017	0.017	30,900	470	0.009~0.014	0.017	25,500	340	0.007~0.011	0.017
		6	32,100	520	0.007~0.012	0.01	27,000	390	0.006~0.01	0.01	23,000	290	0.005~0.008	0.01
		7	29,500	460	0.006~0.01	0.005	24,800	350	0.005~0.008	0.005	21,500	260	0.004~0.006	0.005
		8	26,800	390	0.004~0.007	0.004	22,600	300	0.004~0.006	0.004	20,000	230	0.003~0.005	0.004
		10	23,400	300	0.002~0.004	0.002	19,700	230	0.002~0.004	0.002	17,900	180	0.002~0.003	0.002
		12	20,900	240	0.002~0.003	0.001	17,600	180	0.002~0.002	0.001	16,400	150	0.001~0.002	0.001
		18	16,200	100	0.001~0.001	-	13,700	80	0.001~0.001	-	13,500	70	0.001~0.001	-
2007	**0.7**	2	59,800	1,380	0.03 ~0.05	0.165	50,200	1,040	0.027~0.045	0.165	36,100	660	0.021~0.035	0.165
		4	38,900	840	0.017~0.029	0.047	32,700	630	0.015~0.026	0.047	25,800	440	0.012~0.02	0.047
		6	30,200	600	0.01 ~0.017	0.014	25,400	450	0.009~0.015	0.014	21,200	330	0.007~0.012	0.014
		8	25,300	460	0.006~0.01	0.006	21,300	350	0.005~0.009	0.006	18,400	260	0.004~0.007	0.006
		10	22,000	360	0.004~0.006	0.004	18,500	270	0.003~0.005	0.004	16,500	220	0.003~0.005	0.004

Milling Conditions for HLS (2 Flutes)

WORK MATERIAL			HARDENED STEELS SKD / SKT (45~55HRC)				HARDENED STEELS SKD / SKH (55~60HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2001	**0.1**	0.3	-	-	- ~ -	0.035	-	-	- ~ -	0.035
		0.5	-	-	- ~ -	0.03	-	-	- ~ -	0.03
20015	**0.15**	0.5	30,000	50	0.003~0.004	0.07	-	-	- ~ -	0.07
		0.75	28,700	50	0.002~0.004	0.032	-	-	- ~ -	0.032
		1	27,300	40	0.001~0.003	0.015	-	-	- ~ -	0.015
2002	**0.2**	0.5	44,800	180	0.003~0.004	0.13	15,000	10	0.001~0.002	0.13
		1	40,800	160	0.001~0.002	0.035	-	-	- ~ -	0.035
		1.5	38,500	140	0.001~0.001	0.012	-	-	- ~ -	0.012
2003	**0.3**	1	52,100	330	0.004~0.007	0.101	14,600	14	0.003~0.004	0.101
		1.5	42,700	260	0.004~0.006	0.05	14,600	13	0.003~0.004	0.05
		2	33,200	190	0.003~0.005	0.023	14,600	12	0.002~0.003	0.023
		2.5	29,400	160	0.002~0.004	0.012	14,600	11	0.001~0.002	0.012
		3	25,500	130	0.001~0.002	0.008	14,600	10	0.001~0.001	0.008
		4	20,900	100	0.001~0.001	0.003	14,600	9	0.001~0.001	0.003
		6	16,300	60	0.001~0.001	-	-	-	- ~ -	-
		9	12,500	20	0.001~0.001	-	-	-	- ~ -	-
2004	**0.4**	1.5	38,500	320	0.004~0.008	0.095	14,300	17	0.003~0.004	0.095
		2	35,700	290	0.004~0.007	0.052	14,300	17	0.003~0.004	0.052
		2.5	32,900	260	0.004~0.006	0.026	14,300	17	0.003~0.004	0.026
		3	30,000	230	0.003~0.005	0.018	14,300	16	0.002~0.003	0.018
		3.5	28,300	210	0.003~0.004	0.01	14,300	16	0.002~0.003	0.01
		4	26,500	190	0.002~0.003	0.008	14,300	15	0.001~0.002	0.008
		5	24,100	160	0.001~0.002	0.004	14,300	14	0.001~0.001	0.004
		8	19,700	100	0.001~0.001	0.001	14,300	11	0.001~0.001	0.001
		12	16,500	60	0.001~0.001	-	-	-	- ~ -	-
2005	**0.5**	1.5	37,300	410	0.009~0.015	0.139	14,000	20	0.004~0.008	0.139
		2	32,500	350	0.008~0.013	0.098	14,000	20	0.004~0.007	0.098
		2.5	27,700	290	0.007~0.011	0.057	14,000	20	0.004~0.006	0.057
		3	25,700	260	0.005~0.009	0.037	14,000	19	0.004~0.005	0.037
		4	23,700	230	0.004~0.007	0.016	14,000	18	0.003~0.004	0.016
		5	21,700	200	0.003~0.005	0.008	14,000	17	0.002~0.003	0.008
		6	19,700	170	0.002~0.003	0.005	14,000	16	0.001~0.002	0.005
		8	17,300	130	0.001~0.002	0.002	14,000	14	0.001~0.001	0.002
		10	15,600	100	0.001~0.001	0.001	14,000	12	0.001~0.001	0.001
		15	13,000	50	0.001~0.001	-	-	-	- ~ -	-
2006	**0.6**	2	31,300	410	0.011~0.019	0.18	12,000	23	0.006~0.01	0.18
		3	26,800	340	0.009~0.015	0.075	12,000	22	0.005~0.008	0.075
		4	22,300	270	0.006~0.01	0.03	12,000	21	0.003~0.005	0.03
		5	20,400	240	0.005~0.008	0.017	12,000	20	0.003~0.004	0.017
		6	18,400	200	0.003~0.006	0.01	12,000	19	0.002~0.003	0.01
		7	17,200	180	0.003~0.005	0.005	12,000	18	0.002~0.003	0.005
		8	16,000	160	0.002~0.003	0.004	12,000	17	0.001~0.002	0.004
		10	14,300	130	0.001~0.002	0.002	12,000	15	0.001~0.001	0.002
		12	13,100	100	0.001~0.001	0.001	12,000	13	0.001~0.001	0.001
		18	10,800	50	0.001~0.001	-	-	-	- ~ -	-
2007	**0.7**	2	28,800	430	0.015~0.025	0.165	10,000	24	0.01 ~0.015	0.165
		4	20,600	290	0.009~0.014	0.047	10,000	22	0.006~0.009	0.047
		6	16,900	230	0.005~0.008	0.014	10,000	20	0.003~0.005	0.014
		8	14,700	190	0.003~0.005	0.006	10,000	18	0.002~0.003	0.006
		10	13,200	160	0.002~0.003	0.004	10,000	13	0.001~0.002	0.004

Milling Conditions for HLS (2 Flutes)

WORK MATERIAL			CARBON STEELS S45C / S50C (~225HB)				ALLOY STEELS SK / SCM / SUS (225~325HB)				PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2008	0.8	3	41,200	1,050	0.033~0.053	0.15	34,500	790	0.029~0.049	0.15	26,200	530	0.023~0.038	0.15
		4	37,100	930	0.027~0.044	0.08	31,100	700	0.024~0.04	0.08	24,100	480	0.019~0.031	0.08
		5	33,000	810	0.021~0.035	0.052	27,700	610	0.019~0.031	0.052	22,000	430	0.015~0.024	0.052
		6	28,800	680	0.015~0.025	0.024	24,200	510	0.013~0.022	0.024	19,800	370	0.01 ~0.017	0.024
		8	24,100	520	0.009~0.015	0.01	20,300	390	0.008~0.013	0.01	17,200	300	0.006~0.01	0.01
		10	21,000	420	0.006~0.009	0.005	17,700	320	0.005~0.008	0.005	15,500	240	0.004~0.007	0.005
		12	18,700	340	0.004~0.006	0.003	15,800	260	0.003~0.006	0.003	14,100	200	0.003~0.004	0.003
		16	15,600	230	0.002~0.003	0.001	13,200	180	0.002~0.003	0.001	12,300	150	0.002~0.002	0.001
		24	12,100	100	0.001~0.002	-	10,300	80	0.001~0.002	-	10,100	70	0.001~0.001	-
2009	0.9	4	35,600	1,100	0.033~0.054	0.128	29,500	820	0.029~0.049	0.128	22,500	550	0.023~0.038	0.128
		6	27,600	790	0.019~0.032	0.038	23,000	590	0.017~0.029	0.038	18,500	420	0.013~0.022	0.038
		8	23,000	600	0.012~0.02	0.016	19,300	450	0.011~0.018	0.016	16,100	330	0.008~0.014	0.016
		10	20,000	470	0.008~0.013	0.008	16,800	360	0.007~0.012	0.008	14,500	270	0.005~0.009	0.008
		15	15,500	270	0.003~0.006	0.002	13,100	200	0.003~0.005	0.002	11,900	160	0.002~0.004	0.002
2010	1	3	37,900	1,340	0.048~0.067	0.263	31,500	990	0.043~0.072	0.263	23,400	650	0.034~0.057	0.263
		4	34,100	1,170	0.04 ~0.067	0.195	28,400	870	0.036~0.06	0.195	21,500	580	0.028~0.047	0.195
		5	30,300	1,000	0.032~0.053	0.127	25,300	750	0.029~0.048	0.127	19,600	510	0.022~0.037	0.127
		6	26,500	850	0.023~0.039	0.058	22,100	630	0.021~0.035	0.058	17,600	440	0.016~0.027	0.058
		7	24,300	760	0.019~0.032	0.041	20,400	560	0.017~0.029	0.041	16,500	400	0.013~0.022	0.041
		8	22,100	660	0.014~0.024	0.024	18,600	490	0.013~0.022	0.024	15,300	360	0.01 ~0.017	0.024
		9	20,700	600	0.012~0.02	0.019	17,400	450	0.011~0.018	0.019	14,600	330	0.009~0.014	0.019
		10	19,200	530	0.01 ~0.016	0.013	16,200	400	0.009~0.014	0.013	13,800	300	0.007~0.011	0.013
		12	17,200	440	0.007~0.011	0.007	14,500	330	0.006~0.01	0.007	12,600	250	0.005~0.008	0.007
		14	15,600	360	0.005~0.008	0.005	13,200	270	0.004~0.007	0.005	11,700	210	0.003~0.006	0.005
		16	14,300	300	0.004~0.006	0.003	12,100	230	0.003~0.006	0.003	11,000	180	0.003~0.005	0.003
		20	12,500	200	0.002~0.004	0.002	10,600	160	0.002~0.003	0.002	9,800	130	0.002~0.003	0.002
		25	10,800	120	0.002~0.003	0.001	9,200	100	0.001~0.002	0.001	8,800	80	0.001~0.002	0.001
		30	9,700	80	0.001~0.002	-	8,200	60	0.001~0.002	-	8,100	50	0.001~0.002	-
2012	1.2	4	28,900	1,180	0.05 ~0.085	0.23	24,100	870	0.047~0.077	0.23	18,300	580	0.036~0.059	0.23
		6	24,800	970	0.037~0.062	0.12	20,700	720	0.034~0.056	0.12	16,100	490	0.026~0.043	0.12
		8	20,700	760	0.024~0.039	0.051	17,300	570	0.021~0.035	0.051	13,900	400	0.016~0.027	0.051
		10	18,000	620	0.016~0.026	0.026	15,100	470	0.014~0.023	0.026	12,400	340	0.011~0.018	0.026
		12	16,100	520	0.011~0.018	0.015	13,500	390	0.01 ~0.016	0.015	11,400	290	0.008~0.013	0.015
		16	13,400	380	0.006~0.01	0.006	11,300	290	0.005~0.009	0.006	9,800	220	0.004~0.007	0.006
		20	11,700	280	0.004~0.007	0.003	9,900	210	0.004~0.006	0.003	8,800	170	0.003~0.005	0.003
2014	1.4	6	23,300	1,070	0.052~0.086	0.222	19,400	800	0.047~0.078	0.222	14,800	540	0.036~0.061	0.222
		8	19,500	850	0.035~0.059	0.094	16,300	640	0.032~0.053	0.094	12,900	440	0.025~0.041	0.094
		10	16,900	710	0.025~0.041	0.048	14,200	530	0.022~0.037	0.048	11,500	380	0.017~0.029	0.048
		12	15,100	600	0.018~0.03	0.028	12,700	450	0.016~0.027	0.028	10,500	330	0.013~0.021	0.028
		14	13,700	510	0.013~0.022	0.018	11,500	390	0.012~0.02	0.018	9,700	290	0.009~0.016	0.018
		16	12,600	450	0.01 ~0.017	0.012	10,600	340	0.009~0.015	0.012	9,100	250	0.007~0.012	0.012
		22	10,300	300	0.006~0.009	0.004	8,700	230	0.005~0.008	0.004	7,800	180	0.004~0.006	0.004
2015	1.5	4	26,600	1,340	0.073~0.12	0.462	22,100	1,000	0.065~0.109	0.462	16,300	640	0.051~0.084	0.462
		6	22,800	1,120	0.057~0.094	0.293	19,000	840	0.051~0.085	0.293	14,400	550	0.04 ~0.066	0.293
		8	19,000	900	0.041~0.068	0.124	15,900	670	0.037~0.061	0.124	12,500	460	0.029~0.048	0.124
		10	16,600	750	0.03 ~0.05	0.063	13,800	560	0.027~0.045	0.063	11,200	390	0.021~0.035	0.063
		12	14,800	630	0.023~0.038	0.037	12,400	470	0.02 ~0.034	0.037	10,200	340	0.016~0.026	0.037
		14	13,400	550	0.017~0.029	0.023	11,200	410	0.016~0.026	0.023	9,500	300	0.012~0.02	0.023
		16	12,300	480	0.013~0.022	0.015	10,300	360	0.012~0.02	0.015	8,900	270	0.009~0.016	0.015
		18	11,500	420	0.011~0.018	0.011	9,600	310	0.01 ~0.016	0.011	8,400	240	0.007~0.012	0.011
		20	10,700	370	0.009~0.014	0.008	9,000	280	0.008~0.013	0.008	7,900	220	0.006~0.01	0.008
		25	9,300	270	0.005~0.009	0.004	7,800	200	0.005~0.008	0.004	7,100	160	0.004~0.006	0.004
		30	8,300	200	0.004~0.007	0.002	7,000	150	0.004~0.006	0.002	6,500	120	0.003~0.005	0.002
		35	7,600	140	0.003~0.004	0.001	6,400	110	0.003~0.004	0.001	6,000	90	0.002~0.003	0.001
		40	7,000	90	0.002~0.003	0.001	5,800	70	0.002~0.003	0.001	5,600	60	0.002~0.002	0.001
		45	6,500	60	0.002~0.003	0.001	5,400	50	0.002~0.002	0.001	5,300	40	0.001~0.002	0.001

Milling Conditions for HLS (2 Flutes)

WORK MATERIAL			HARDENED STEELS SKD / SKT (45~55HRC)				HARDENED STEELS SKD / SKH (55~60HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2008	**0.8**	3	21,000	370	0.016~0.027	0.15	8,000	21	0.012~0.016	0.15
		4	19,300	330	0.013~0.022	0.08	8,000	20	0.01 ~0.013	0.08
		5	17,600	290	0.01 ~0.017	0.052	8,000	19	0.008~0.01	0.052
		6	15,800	250	0.007~0.012	0.024	8,000	18	0.005~0.007	0.024
		8	13,800	200	0.004~0.007	0.01	8,000	16	0.003~0.004	0.01
		10	12,400	170	0.003~0.005	0.005	8,000	14	0.002~0.003	0.005
		12	11,300	140	0.002~0.003	0.003	8,000	12	0.001~0.002	0.003
		16	9,800	100	0.001~0.002	0.001	-	-	- ~ -	0.001
		24	8,100	50	0.001~0.001	-	-	-	- ~ -	-
2009	**0.9**	4	18,000	380	0.016~0.027	0.128	7,200	20	0.01 ~0.014	0.128
		6	14,800	290	0.01 ~0.016	0.038	7,200	18	0.007~0.009	0.038
		8	12,900	230	0.006~0.01	0.016	7,200	16	0.004~0.006	0.016
		10	11,600	190	0.004~0.006	0.008	7,200	14	0.002~0.003	0.008
		15	9,500	120	0.002~0.003	0.002	-	-	- ~ -	0.002
2010	**1**	3	18,700	440	0.024~0.039	0.263	6,500	15	0.011~0.016	0.263
		4	17,200	400	0.02 ~0.033	0.195	6,500	15	0.01 ~0.015	0.195
		5	15,700	360	0.016~0.027	0.127	6,500	15	0.009~0.014	0.127
		6	14,100	310	0.012~0.02	0.058	6,500	14	0.007~0.012	0.058
		7	13,200	280	0.01 ~0.016	0.041	6,500	14	0.006~0.009	0.041
		8	12,300	250	0.007~0.012	0.024	6,500	13	0.004~0.006	0.024
		9	11,700	230	0.006~0.01	0.019	6,500	13	0.004~0.005	0.019
		10	11,000	210	0.005~0.008	0.013	6,500	12	0.003~0.004	0.013
		12	10,100	170	0.003~0.006	0.007	6,500	11	0.002~0.003	0.007
		14	9,400	150	0.002~0.004	0.005	6,500	10	0.001~0.002	0.005
		16	8,800	130	0.002~0.003	0.003	-	-	- ~ -	0.003
		20	7,900	90	0.001~0.002	0.002	-	-	- ~ -	0.002
		25	7,100	60	0.001~0.001	0.001	-	-	- ~ -	0.001
		30	6,500	40	0.001~0.001	-	-	-	- ~ -	-
2012	**1.2**	4	14,500	400	0.026~0.042	0.23	9,600	34	0.015~0.026	0.23
		6	12,800	340	0.019~0.031	0.12	9,600	22	0.011~0.019	0.12
		8	11,100	280	0.012~0.02	0.051	9,600	10	0.007~0.012	0.051
		10	9,900	230	0.008~0.013	0.026	-	-	- ~ -	0.026
		12	9,100	200	0.005~0.009	0.015	-	-	- ~ -	0.015
		16	7,900	150	0.003~0.005	0.006	-	-	- ~ -	0.006
		20	7,000	120	0.002~0.003	0.003	-	-	- ~ -	0.003
2014	**1.4**	6	11,900	370	0.026~0.043	0.222	9,600	44	0.015~0.026	0.222
		8	10,300	310	0.018~0.029	0.094	9,600	18	0.01 ~0.017	0.094
		10	9,200	260	0.012~0.021	0.048	-	-	- ~ -	0.048
		12	8,400	230	0.009~0.015	0.028	-	-	- ~ -	0.028
		14	7,800	200	0.007~0.011	0.018	-	-	- ~ -	0.018
		16	7,300	180	0.005~0.009	0.012	-	-	- ~ -	0.012
		22	6,200	120	0.003~0.005	0.004	-	-	- ~ -	0.004
2015	**1.5**	4	13,000	440	0.036~0.06	0.462	9,600	95	0.02 ~0.036	0.462
		6	11,500	380	0.028~0.047	0.293	9,600	60	0.016~0.028	0.293
		8	10,000	320	0.02 ~0.034	0.124	9,600	25	0.012~0.02	0.124
		10	8,900	270	0.015~0.025	0.063	9,600	13	0.009~0.015	0.063
		12	8,200	240	0.011~0.019	0.037	-	-	- ~ -	0.037
		14	7,600	210	0.009~0.014	0.023	-	-	- ~ -	0.023
		16	7,100	190	0.007~0.011	0.015	-	-	- ~ -	0.015
		18	6,700	170	0.005~0.009	0.011	-	-	- ~ -	0.011
		20	6,300	150	0.004~0.007	0.008	-	-	- ~ -	0.008
		25	5,700	110	0.003~0.005	0.004	-	-	- ~ -	0.004
		30	5,200	90	0.002~0.003	0.002	-	-	- ~ -	0.002
		35	4,800	60	0.002~0.002	0.001	-	-	- ~ -	0.001
		40	4,500	40	0.001~0.002	0.001	-	-	- ~ -	0.001
		45	4,300	30	0.001~0.001	0.001	-	-	- ~ -	0.001

Milling Conditions for HLS (2 Flutes)

WORK MATERIAL			CARBON STEELS S45C / S50C (~225HB)				ALLOY STEELS SK / SCM / SUS (225~325HB)				PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2016	1.6	6	22,200	1,170	0.065~0.108	0.379	18,500	870	0.058~0.097	0.379	13,800	570	0.045~0.076	0.379
		8	18,500	940	0.047~0.079	0.16	15,500	700	0.042~0.071	0.16	12,000	480	0.033~0.055	0.16
		10	16,100	780	0.035~0.058	0.082	13,500	580	0.032~0.053	0.082	10,800	410	0.025~0.041	0.082
		12	14,400	670	0.027~0.044	0.047	12,000	500	0.024~0.04	0.047	9,800	360	0.019~0.031	0.047
		14	13,000	580	0.02 ~0.034	0.03	10,900	430	0.018~0.031	0.03	9,100	320	0.014~0.024	0.03
		16	12,000	510	0.016~0.027	0.02	10,000	380	0.014~0.024	0.02	8,500	280	0.011~0.019	0.02
		18	11,100	450	0.013~0.022	0.014	9,300	340	0.012~0.019	0.014	8,000	260	0.009~0.015	0.014
		20	10,400	400	0.011~0.018	0.01	8,700	300	0.01 ~0.016	0.01	7,600	230	0.007~0.012	0.01
		26	8,800	280	0.007~0.011	0.005	7,400	210	0.006~0.01	0.005	6,700	170	0.005~0.008	0.005
2018	1.8	6	21,000	1,270	0.061~0.102	0.608	17,800	950	0.055~0.092	0.608	12,800	600	0.043~0.071	0.608
		8	17,700	1,020	0.05 ~0.083	0.256	14,900	760	0.045~0.075	0.256	11,100	500	0.035~0.058	0.256
		10	15,400	860	0.041~0.068	0.131	12,900	640	0.037~0.061	0.131	9,900	430	0.029~0.048	0.131
		12	13,800	740	0.033~0.055	0.076	11,500	550	0.03 ~0.05	0.076	9,100	380	0.023~0.039	0.076
		14	12,500	640	0.027~0.045	0.048	10,500	480	0.024~0.041	0.048	8,400	340	0.019~0.032	0.048
		16	11,500	570	0.022~0.037	0.032	9,600	420	0.02 ~0.033	0.032	7,800	300	0.016~0.026	0.032
		18	10,700	500	0.018~0.03	0.023	8,900	380	0.016~0.027	0.023	7,400	280	0.013~0.021	0.023
		20	10,000	450	0.015~0.025	0.016	8,400	340	0.013~0.022	0.016	7,000	250	0.01 ~0.017	0.016
		25	8,700	350	0.009~0.015	0.008	7,300	260	0.008~0.014	0.008	6,300	200	0.006~0.011	0.008
2020	2	6	20,300	1,350	0.064~0.107	0.926	17,400	1,030	0.058~0.097	0.926	12,500	650	0.045~0.075	0.926
		8	17,000	1,090	0.054~0.089	0.391	14,500	830	0.048~0.081	0.391	10,800	540	0.038~0.063	0.391
		10	14,800	920	0.045~0.075	0.2	12,600	700	0.04 ~0.067	0.2	9,700	470	0.031~0.052	0.2
		12	13,200	790	0.037~0.062	0.116	11,200	600	0.034~0.056	0.116	8,900	420	0.026~0.044	0.116
		14	12,000	700	0.031~0.052	0.073	10,200	530	0.028~0.047	0.073	8,200	370	0.022~0.036	0.073
		16	11,100	620	0.026~0.044	0.049	9,400	470	0.024~0.039	0.049	7,700	340	0.018~0.03	0.049
		18	10,300	550	0.022~0.036	0.034	8,700	420	0.02 ~0.033	0.034	7,200	310	0.015~0.026	0.034
		20	9,600	500	0.018~0.031	0.025	8,100	380	0.016~0.027	0.025	6,900	280	0.013~0.021	0.025
		25	8,400	390	0.012~0.02	0.013	7,100	290	0.011~0.018	0.013	6,200	230	0.008~0.014	0.013
		30	7,500	310	0.008~0.013	0.007	6,300	230	0.007~0.012	0.007	5,600	180	0.005~0.009	0.007
		35	6,800	250	0.005~0.008	0.005	5,700	190	0.005~0.008	0.005	5,200	150	0.004~0.006	0.005
		40	6,300	200	0.003~0.006	0.003	5,200	150	0.003~0.005	0.003	4,900	120	0.002~0.004	0.003
		50	5,400	110	0.003~0.004	0.002	4,500	90	0.002~0.002	0.002	4,400	70	0.002~0.002	0.002
		60	4,900	50	0.002~0.003	0.002	4,000	40	0.002~0.002	0.002	4,000	30	0.002~0.002	0.002
2025	2.5	8	15,000	1,340	0.077~0.129	0.954	12,800	1,020	0.069~0.116	0.954	9,600	670	0.054~0.09	0.954
		10	13,100	1,140	0.068~0.113	0.488	11,100	860	0.061~0.102	0.488	8,600	590	0.048~0.079	0.488
		12	11,800	1,000	0.06 ~0.099	0.283	10,000	750	0.054~0.089	0.283	7,900	520	0.042~0.07	0.283
		14	10,700	880	0.052~0.087	0.178	9,100	660	0.047~0.078	0.178	7,300	470	0.036~0.061	0.178
		16	9,900	790	0.045~0.075	0.119	8,400	590	0.04 ~0.067	0.119	6,800	430	0.031~0.052	0.119
		18	9,200	710	0.039~0.064	0.084	7,800	540	0.035~0.058	0.084	6,500	390	0.027~0.045	0.084
		20	8,700	650	0.033~0.055	0.061	7,300	490	0.03 ~0.05	0.061	6,100	360	0.023~0.039	0.061
		25	7,600	520	0.022~0.036	0.031	6,400	390	0.019~0.032	0.031	5,500	300	0.015~0.025	0.031
		30	6,800	430	0.014~0.023	0.018	5,700	320	0.012~0.02	0.018	5,000	250	0.01 ~0.016	0.018
		40	5,700	290	0.005~0.008	0.008	4,800	220	0.004~0.007	0.008	4,400	170	0.003~0.006	0.008
		50	5,000	190	0.003~0.004	0.004	4,200	140	0.002~0.004	0.004	3,900	120	0.002~0.003	0.004
2030	3	8	13,200	1,470	0.103~0.172	1.978	10,900	1,080	0.093~0.155	1.978	8,000	700	0.072~0.12	1.978
		10	11,600	1,270	0.092~0.153	1.013	9,600	930	0.083~0.138	1.013	7,200	620	0.064~0.107	1.013
		12	10,500	1,110	0.081~0.136	0.586	8,700	830	0.073~0.122	0.586	6,700	560	0.057~0.095	0.586
		14	9,600	1,000	0.072~0.12	0.369	8,000	740	0.065~0.108	0.369	6,200	510	0.051~0.084	0.369
		16	8,900	900	0.064~0.107	0.247	7,400	670	0.058~0.096	0.247	5,900	470	0.045~0.075	0.247
		18	8,300	820	0.057~0.094	0.174	7,000	610	0.051~0.085	0.174	5,600	430	0.04 ~0.066	0.174
		20	7,800	750	0.05 ~0.083	0.127	6,600	560	0.045~0.075	0.127	5,300	400	0.035~0.058	0.127
		25	6,900	620	0.036~0.06	0.065	5,800	460	0.032~0.054	0.065	4,800	340	0.025~0.042	0.065
		30	6,200	520	0.026~0.043	0.038	5,200	390	0.023~0.039	0.038	4,500	290	0.018~0.03	0.038
		35	5,700	440	0.018~0.031	0.024	4,800	330	0.016~0.027	0.024	4,200	250	0.013~0.021	0.024
		40	5,300	370	0.013~0.021	0.016	4,500	280	0.012~0.019	0.016	3,900	220	0.009~0.015	0.016
		50	4,700	270	0.006~0.01	0.008	3,900	200	0.005~0.009	0.008	3,600	160	0.004~0.007	0.008

Milling Conditions for HLS (2Flutes)

WORK MATERIAL			HARDENED STEELS SKD / SKT (45~55HRC)				HARDENED STEELS SKD / SKH (55~60HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2016	1.6	6	11,100	400	0.032~0.054	0.379	9,600	73	0.019~0.032	0.379
		8	9,600	330	0.024~0.039	0.16	9,600	31	0.014~0.023	0.16
		10	8,600	280	0.018~0.029	0.082	9,600	15	0.01 ~0.017	0.082
		12	7,900	250	0.013~0.022	0.047	-	-	- ~ -	0.047
		14	7,300	220	0.01 ~0.017	0.03	-	-	- ~ -	0.03
		16	6,800	200	0.008~0.013	0.02	-	-	- ~ -	0.02
		18	6,400	180	0.006~0.011	0.014	-	-	- ~ -	0.014
		20	6,100	160	0.005~0.009	0.01	-	-	- ~ -	0.01
		26	5,300	120	0.003~0.005	0.005	-	-	- ~ -	0.005
2018	1.8	6	10,200	410	0.031~0.051	0.608	9,600	137	0.018~0.031	0.608
		8	8,900	350	0.025~0.042	0.256	9,600	58	0.015~0.025	0.256
		10	7,900	300	0.02 ~0.034	0.131	9,600	29	0.012~0.02	0.131
		12	7,200	260	0.017~0.028	0.076	9,600	17	0.01 ~0.017	0.076
		14	6,700	230	0.014~0.023	0.048	9,600	10	0.008~0.014	0.048
		16	6,300	210	0.011~0.019	0.032	-	-	- ~ -	0.032
		18	5,900	190	0.009~0.015	0.023	-	-	- ~ -	0.023
		20	5,600	170	0.007~0.012	0.016	-	-	- ~ -	0.016
		25	5,000	140	0.005~0.008	0.008	-	-	- ~ -	0.008
2020	2	6	10,000	450	0.032~0.054	0.926	9,600	211	0.019~0.032	0.926
		8	8,700	380	0.027~0.045	0.391	9,600	89	0.016~0.027	0.391
		10	7,800	330	0.022~0.037	0.2	9,600	45	0.013~0.022	0.2
		12	7,100	290	0.019~0.031	0.116	9,600	28	0.011~0.019	0.116
		14	6,600	260	0.016~0.026	0.073	9,600	16	0.009~0.016	0.073
		16	6,100	230	0.013~0.022	0.049	9,600	11	0.007~0.013	0.049
		18	5,800	210	0.011~0.018	0.034	-	-	- ~ -	0.034
		20	5,500	190	0.009~0.015	0.025	-	-	- ~ -	0.025
		25	4,900	160	0.006~0.01	0.013	-	-	- ~ -	0.013
		30	4,500	130	0.004~0.006	0.007	-	-	- ~ -	0.007
		35	4,200	100	0.003~0.004	0.005	-	-	- ~ -	0.005
		40	3,900	80	0.002~0.003	0.003	-	-	- ~ -	0.003
		50	3,500	50	0.001~0.001	0.002	-	-	- ~ -	0.002
		60	3,200	30	0.001~0.001	0.002	-	-	- ~ -	0.002
2025	2.5	8	7,700	460	0.039~0.064	0.954	9,600	227	0.023~0.038	0.954
		10	6,900	400	0.034~0.057	0.488	9,600	116	0.02 ~0.034	0.488
		12	6,300	360	0.03 ~0.05	0.283	9,600	67	0.018~0.03	0.283
		14	5,800	320	0.026~0.043	0.178	9,600	42	0.015~0.026	0.178
		16	5,500	290	0.022~0.037	0.119	9,600	28	0.013~0.022	0.119
		18	5,200	270	0.019~0.032	0.084	9,600	20	0.011~0.019	0.084
		20	4,900	250	0.017~0.028	0.061	9,600	14	0.01 ~0.017	0.061
		25	4,400	210	0.011~0.018	0.031	-	-	- ~ -	0.031
		30	4,000	170	0.007~0.011	0.018	-	-	- ~ -	0.018
		40	3,500	120	0.002~0.004	0.008	-	-	- ~ -	0.008
		50	3,100	80	0.002~0.002	0.004	-	-	- ~ -	0.004
2030	3	8	6,400	480	0.052~0.086	1.978	8,000	435	0.031~0.052	1.978
		10	5,800	430	0.046~0.076	1.013	8,000	222	0.027~0.046	1.013
		12	5,300	380	0.041~0.068	0.586	8,000	128	0.024~0.041	0.586
		14	5,000	350	0.036~0.06	0.369	8,000	81	0.021~0.036	0.369
		16	4,700	320	0.032~0.053	0.247	8,000	54	0.019~0.032	0.247
		18	4,500	300	0.028~0.047	0.174	8,000	38	0.016~0.028	0.174
		20	4,300	280	0.025~0.042	0.127	8,000	27	0.015~0.025	0.127
		25	3,900	230	0.018~0.03	0.065	8,000	14	0.01 ~0.018	0.065
		30	3,600	200	0.013~0.022	0.038	8,000	10	0.007~0.013	0.038
		35	3,300	170	0.009~0.015	0.024	-	-	- ~ -	0.024
		40	3,100	150	0.006~0.011	0.016	-	-	- ~ -	0.016
		50	2,800	110	0.003~0.005	0.008	-	-	- ~ -	0.008

Milling Conditions for HLS (2 Flutes)

WORK MATERIAL			CARBON STEELS S45C / S50C (~225HB)				ALLOY STEELS SK / SCM / SUS (225~325HB)				PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2040	4	12	8,500	1,280	0.112~0.187	1.852	7,100	950	0.101~0.168	1.852	5,100	600	0.078~0.131	1.852
		16	7,200	1,050	0.093~0.155	0.781	6,000	770	0.084~0.139	0.781	4,400	510	0.065~0.108	0.781
		20	6,300	880	0.077~0.128	0.4	5,200	650	0.069~0.115	0.4	4,000	440	0.054~0.09	0.4
		25	5,600	750	0.061~0.101	0.205	4,600	540	0.055~0.091	0.205	3,600	380	0.042~0.071	0.205
		30	5,000	630	0.048~0.08	0.119	4,100	460	0.043~0.072	0.119	3,300	330	0.033~0.056	0.119
		35	4,600	540	0.038~0.063	0.075	3,800	400	0.034~0.057	0.075	3,100	290	0.026~0.044	0.075
		40	4,200	470	0.03 ~0.049	0.05	3,500	350	0.027~0.044	0.05	2,900	250	0.021~0.035	0.05
		45	3,900	410	0.023~0.039	0.035	3,300	300	0.021~0.035	0.035	2,700	230	0.016~0.027	0.035
		50	3,700	360	0.018~0.031	0.026	3,100	270	0.016~0.027	0.026	2,600	200	0.013~0.021	0.026
		60	3,300	280	0.011~0.019	0.015	2,800	210	0.01 ~0.017	0.015	2,400	160	0.008~0.013	0.015
2050	5	16	6,000	1,140	0.127~0.212	1.907	5,100	860	0.114~0.191	1.907	3,500	520	0.089~0.148	1.907
		20	5,300	980	0.121~0.202	0.977	4,400	730	0.109~0.182	0.977	3,100	440	0.085~0.142	0.977
		25	4,600	820	0.109~0.182	0.5	3,800	600	0.099~0.164	0.5	2,800	390	0.077~0.128	0.5
		30	4,200	710	0.094~0.157	0.289	3,400	510	0.085~0.141	0.289	2,500	340	0.066~0.11	0.289
		35	3,800	620	0.077~0.128	0.182	3,100	450	0.069~0.115	0.182	2,300	300	0.054~0.09	0.182
		40	3,500	540	0.06 ~0.099	0.122	2,800	390	0.054~0.089	0.122	2,200	270	0.042~0.07	0.122
		50	3,100	430	0.031~0.052	0.063	2,400	300	0.028~0.047	0.063	1,900	210	0.022~0.036	0.063
		60	2,800	350	0.02 ~0.035	0.035	2,100	240	0.02 ~0.033	0.035	1,800	170	0.019~0.031	0.035
2060	6	20	4,200	960	0.126~0.211	2.025	3,800	780	0.114~0.19	2.025	2,600	470	0.088~0.147	2.025
		30	3,400	730	0.109~0.182	0.6	2,800	540	0.099~0.164	0.6	2,000	340	0.077~0.128	0.6
		40	3,000	600	0.083~0.138	0.253	2,300	410	0.074~0.124	0.253	1,700	260	0.058~0.096	0.253
		50	2,600	480	0.054~0.09	0.13	1,900	310	0.049~0.081	0.13	1,500	220	0.038~0.063	0.13
		60	2,400	410	0.031~0.052	0.075	1,700	260	0.028~0.047	0.075	1,300	170	0.022~0.036	0.075

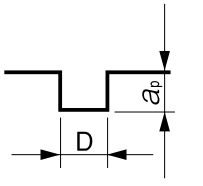
Milling Conditions for HLS (2 Flutes)

WORK MATERIAL			HARDENED STEELS SKD / SKT (45～55HRC)				HARDENED STEELS SKD / SKH (55～60HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2040	4	12	4,100	410	0.056～0.093	1.852	6,000	388	0.033～0.056	1.852
		16	3,600	350	0.046～0.077	0.781	6,000	164	0.027～0.046	0.781
		20	3,200	300	0.038～0.064	0.4	6,000	84	0.022～0.038	0.4
		25	2,900	260	0.03 ～0.051	0.205	6,000	43	0.018～0.031	0.205
		30	2,600	230	0.024～0.04	0.119	6,000	24	0.014～0.024	0.119
		35	2,500	200	0.019～0.031	0.075	6,000	15	0.011～0.019	0.075
		40	2,300	180	0.015～0.025	0.05	6,000	10	0.009～0.015	0.05
		45	2,200	160	0.012～0.019	0.035	-	-	- ～ -	0.035
		50	2,100	140	0.009～0.015	0.026	-	-	- ～ -	0.026
		60	1,900	110	0.006～0.009	0.015	-	-	- ～ -	0.015
2050	5	16	2,800	360	0.064～0.106	1.907	4,800	457	0.038～0.064	1.907
		20	2,500	310	0.061～0.101	0.977	4,800	234	0.036～0.061	0.977
		25	2,200	270	0.055～0.091	0.5	4,800	120	0.033～0.055	0.5
		30	2,000	230	0.047～0.078	0.289	4,800	69	0.028～0.047	0.289
		35	1,900	210	0.038～0.064	0.182	4,800	43	0.022～0.038	0.182
		40	1,700	180	0.03 ～0.05	0.122	4,800	29	0.018～0.03	0.122
		50	1,500	150	0.016～0.026	0.063	4,800	15	0.009～0.016	0.063
		60	1,400	120	0.007～0.011	0.035	4,800	10	0.004～0.007	0.035
2060	6	20	2,100	330	0.063～0.105	2.025	4,000	607	0.037～0.063	2.025
		30	1,600	240	0.055～0.091	0.6	4,000	180	0.033～0.055	0.6
		40	1,300	170	0.041～0.069	0.253	4,000	75	0.024～0.041	0.253
		50	1,200	160	0.027～0.045	0.13	4,000	38	0.016～0.027	0.13
		60	1,000	120	0.016～0.026	0.075	4,000	22	0.009～0.016	0.075

Slotting

a_p : Axial Depth (mm)

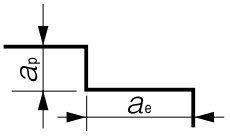
D : Outside Diameter (mm)



Side Milling

a_p : Axial Depth (mm)

a_e : Radial Depth (mm)



Note:

・Recommend using a non-contact measuring device to avoid damaging the precision tip point.
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Every coolant offers stable milling.
・Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
・Recommend wet coolant for Copper.

4 Flutes HARDMAX

Size Ø1~Ø6

HLS4000

Super MG | HARD MAX | 30° | Flatland | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

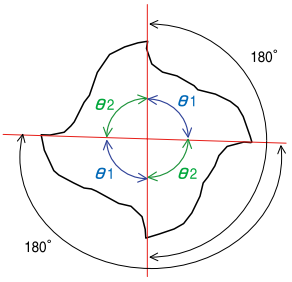
Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
○	○	◎	◎	○		○			○			○	○		

Features

Feature1 : Variable pitch

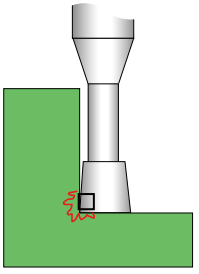
θ1 > θ2 : The unequal division reduces chattering and tip damage.

θ1 + θ2 = 180° : Easy to measure diameter.

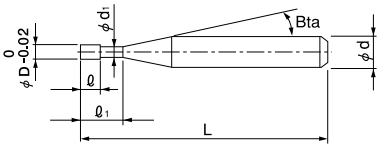


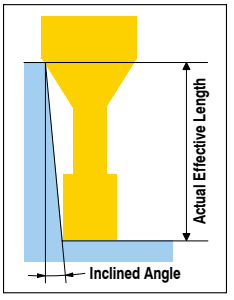
Feature2 : Back taper geometry

Back taper geometry reduces cutting force.



Feature3 : High level of heat resistance, durability and lubrication + New and harder HARDMAX coating
Feature4 : Improved new 4 flute design offers improved chip evacuation and achieves high feed and milling precision.





The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 84 models

Unit (mm)

Model Number	Outside Diameter ØD	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles 30'	1°	1°30'	2°	3°
HLS 4010-040	1	4	1	0.95	16°	50	4	4.66	4.93	5.15	5.34	5.74
HLS 4010-060		6				50	4	6.78	7.10	7.36	7.62	8.19
HLS 4010-080		8				50	4	8.88	9.25	9.56	9.90	10.64
HLS 4010-100		10				50	4	10.97	11.38	11.76	12.17	13.09
HLS 4010-120		12				50	4	13.06	13.51	13.97	14.45	15.53
HLS 4010-160		16				60	4	17.20	17.77	18.37	19.01	20.43
HLS 4012-060	1.2	6	1.2	1.14	16°	50	4	6.18	6.38	6.60	6.83	7.34
HLS 4012-080		8				50	4	8.24	8.51	8.80	9.11	9.79
HLS 4012-100		10				50	4	10.31	10.64	11.00	11.38	12.24
HLS 4012-120		12				50	4	12.37	12.77	13.20	13.66	14.68
HLS 4012-160		16				60	4	16.49	17.03	17.60	18.22	19.58
HLS 4014-060	1.4	6	1.4	1.34	16°	50	4	6.18	6.38	6.60	6.83	7.34
HLS 4014-080		8				50	4	8.24	8.51	8.80	9.11	9.79
HLS 4014-100		10				50	4	10.31	10.64	11.00	11.38	12.24
HLS 4014-120		12				50	4	12.37	12.77	13.20	13.66	14.68
HLS 4014-140		14				60	4	14.43	14.90	15.40	15.94	17.13
HLS 4014-160		16				60	4	16.49	17.03	17.60	18.22	19.58
HLS 4014-220		22				60	4	22.68	23.42	24.21	25.05	No Interference

Next Page ➡

Unit (mm)

Model Number	Outside Diameter ØD	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
HLS 4015-060	1.5	6	1.5	1.44	16°	50	4	6.18	6.38	6.60	6.83	7.34
HLS 4015-080		8				50	4	8.24	8.51	8.80	9.11	9.79
HLS 4015-100		10				50	4	10.31	10.64	11.00	11.38	12.24
HLS 4015-120		12				50	4	12.37	12.77	13.20	13.66	14.68
HLS 4015-140		14				60	4	14.43	14.90	15.40	15.94	17.13
HLS 4015-160		16				60	4	16.49	17.03	17.60	18.22	19.58
HLS 4015-180		18				60	4	18.56	19.16	19.80	20.49	22.03
HLS 4015-200		20				60	4	20.62	21.29	22.00	22.77	No Interference
HLS 4016-060	1.6	6	1.6	1.51	16°	50	4	6.22	6.42	6.64	6.87	7.39
HLS 4016-080		8				50	4	8.28	8.55	8.84	9.15	9.83
HLS 4016-100		10				50	4	10.34	10.68	11.04	11.42	12.28
HLS 4016-120		12				50	4	12.40	12.81	13.24	13.70	14.73
HLS 4016-140		14				60	4	14.47	14.94	15.44	15.98	17.17
HLS 4016-160		16				60	4	16.53	17.07	17.64	18.26	19.62
HLS 4016-180		18				60	4	18.59	19.20	19.84	20.53	22.07
HLS 4016-200		20				60	4	20.66	21.33	22.04	22.81	No Interference
HLS 4016-260		26				60	4	26.84	27.72	28.65	29.64	No Interference
HLS 4018-060	1.8	6	1.8	1.71	16°	50	4	6.22	6.42	6.64	6.87	7.39
HLS 4018-080		8				50	4	8.28	8.55	8.84	9.15	9.83
HLS 4018-100		10				50	4	10.34	10.68	11.04	11.42	12.28
HLS 4018-120		12				50	4	12.40	12.81	13.24	13.70	14.73
HLS 4018-140		14				60	4	14.47	14.94	15.44	15.98	17.17
HLS 4018-160		16				60	4	16.53	17.07	17.64	18.26	19.62
HLS 4018-180		18				60	4	18.59	19.20	19.84	20.53	No Interference
HLS 4018-200		20				60	4	20.66	21.33	22.04	22.81	No Interference
HLS 4018-250		25				70	4	25.81	26.65	27.55	28.50	No Interference
HLS 4020-060	2	6	2	1.91	16°	50	4	6.22	6.42	6.64	6.87	7.39
HLS 4020-080		8				50	4	8.28	8.55	8.84	9.15	9.83
HLS 4020-100		10				50	4	10.34	10.68	11.04	11.42	12.28
HLS 4020-120		12				50	4	12.40	12.81	13.24	13.70	14.73
HLS 4020-140		14				60	4	14.47	14.94	15.44	15.98	17.17
HLS 4020-160		16				60	4	16.53	17.07	17.64	18.26	No Interference
HLS 4020-180		18				60	4	18.59	19.20	19.84	20.53	No Interference
HLS 4020-200		20				60	4	20.66	21.33	22.04	22.81	No Interference
HLS 4020-250		25				70	4	25.81	26.65	27.55	28.50	No Interference
HLS 4020-300		30				70	4	30.97	31.97	33.05	No Interference	No Interference

Next Page ➡

4 Flutes HARDMAX

Unit (mm)

Model Number	Outside Diameter ØD	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
HLS 4025-080	2.5	8	2.5	2.41	16°	50	4	8.28	8.55	8.84	9.15	9.83
HLS 4025-120		12				50	4	12.40	12.81	13.24	13.70	No Interference
HLS 4025-160		16				60	4	16.53	17.07	17.64	18.26	No Interference
HLS 4025-200		20				60	4	20.66	21.33	22.04	No Interference	No Interference
HLS 4025-250		25				70	4	25.81	26.65	27.55	No Interference	No Interference
HLS 4025-300		30				70	4	30.97	31.97	No Interference	No Interference	No Interference
HLS 4030-080	3	8	3	2.92	16°	50	6	8.28	8.55	8.84	9.15	9.83
HLS 4030-120		12				50	6	12.40	12.81	13.24	13.70	14.73
HLS 4030-160		16				60	6	16.53	17.07	17.64	18.26	19.62
HLS 4030-200		20				60	6	20.66	21.33	22.04	22.81	24.52
HLS 4030-250		25				70	6	25.81	26.65	27.55	28.50	No Interference
HLS 4030-300		30				70	6	30.97	31.97	33.05	34.20	No Interference
HLS 4030-400		40				80	6	41.28	42.62	44.05	No Interference	No Interference
HLS 4040-120	4	12	4	3.82	16°	50	6	12.58	12.99	13.43	13.90	14.94
HLS 4040-160		16				60	6	16.71	17.25	17.83	18.45	No Interference
HLS 4040-200		20				60	6	20.84	21.51	22.24	23.01	No Interference
HLS 4040-250		25				70	6	25.99	26.84	27.74	28.70	No Interference
HLS 4040-300		30				70	6	31.15	32.16	33.24	No Interference	No Interference
HLS 4040-350		35				80	6	36.31	37.48	No Interference	No Interference	No Interference
HLS 4040-400		40				90	6	41.46	42.81	No Interference	No Interference	No Interference
HLS 4040-450		45				90	6	46.62	48.13	No Interference	No Interference	No Interference
HLS 4040-500		50				100	6	51.78	53.46	No Interference	No Interference	No Interference
HLS 4050-160	5	16	5	4.82	16°	60	6	16.78	17.25	18.02	No Interference	No Interference
HLS 4050-250		25				70	6	25.99	26.84	No Interference	No Interference	No Interference
HLS 4050-350		35				80	6	36.31	No Interference	No Interference	No Interference	No Interference
HLS 4050-500		50				110	6	51.78	No Interference	No Interference	No Interference	No Interference
HLS 4060-200	6	20	6	5.82	-	80	6	No Interference	No Interference	No Interference	No Interference	No Interference
HLS 4060-300		30				90	6	No Interference	No Interference	No Interference	No Interference	No Interference
HLS 4060-400		40				100	6	No Interference	No Interference	No Interference	No Interference	No Interference
HLS 4060-500		50				110	6	No Interference	No Interference	No Interference	No Interference	No Interference

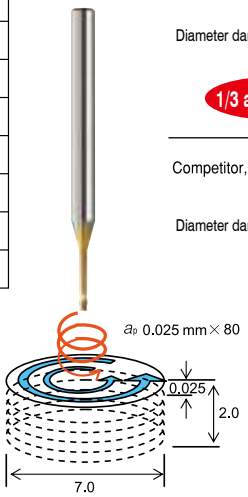
Circle Pocket Milling Example

SKD11 (60HRC)

Tool: HLS ϕ1.5 × effective length 10 mm

Spindle Speed	7,000 min^{-1}
Feed Rate	230 mm/min
Axial Depth a_p	0.025 mm
Radial Depth a_e	1.2 mm
Coolant	Air blow (Nozzle)
Overhang Length	18 mm
Pocket Size	ϕ7 × 2 mm
Cycle Time	17 min

SKD11 (60HRC)



HLS 4 Flutes ϕ1.5 x 10

Diameter damage: 0.091 mm

1/3 and under!

Competitor, 4 Flutes ϕ1.5 x 10

Diameter damage: 0.296 mm

Milling Conditions for HLS (4 Flutes)

WORK MATERIAL			CARBON STEELS S45C / S50C (~225HB)				ALLOY STEELS SK / SCM / SUS (225~325HB)				PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC)				HARDENED STEELS SKD / SKT / STAVAX (45~55HRC)				HARDENED STEELS SKD / SKH (55~60HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010	**1**	4	24,700	1,180	0.040	0.351	21,000	950	0.036	0.332	21,500	660	0.028	0.312	17,200	470	0.020	0.293	10,100	240	0.010	0.195
		6	22,800	1,060	0.024	0.104	19,400	840	0.021	0.099	16,400	590	0.016	0.093	13,100	420	0.012	0.087	9,400	210	0.007	0.058
		8	20,900	950	0.021	0.043	17,800	740	0.018	0.041	14,600	500	0.014	0.038	11,700	360	0.010	0.036	8,700	190	0.006	0.024
		10	19,100	840	0.018	0.023	16,200	630	0.015	0.022	13,000	450	0.013	0.021	10,400	320	0.009	0.020	8,100	160	0.005	0.013
		12	17,300	730	0.015	0.013	14,700	530	0.013	0.012	11,300	380	0.011	0.011	9,000	270	0.008	0.011	7,400	130	0.004	0.007
		16	13,500	500	0.009	0.005	11,500	320	0.008	0.005	11,000	220	0.007	0.005	8,800	160	0.005	0.005	6,000	80	0.003	0.003
4012	**1.2**	6	21,400	1,290	0.040	0.216	18,200	1,020	0.034	0.204	15,400	710	0.027	0.192	12,300	510	0.019	0.180	8,900	260	0.011	0.120
		8	19,700	1,160	0.035	0.092	16,700	890	0.030	0.087	13,800	620	0.024	0.082	11,000	440	0.017	0.077	8,200	230	0.010	0.051
		10	17,900	1,020	0.030	0.047	15,200	770	0.026	0.044	12,100	530	0.021	0.042	9,700	380	0.015	0.039	7,600	200	0.009	0.026
		12	16,200	880	0.025	0.027	13,800	640	0.021	0.026	10,500	450	0.018	0.024	8,400	320	0.013	0.023	6,900	160	0.007	0.015
		16	12,600	610	0.015	0.011	10,700	330	0.013	0.010	9,900	270	0.007	0.010	7,900	190	0.005	0.009	5,600	100	0.005	0.006
4014	**1.4**	6	20,200	1,440	0.068	0.400	17,200	1,140	0.058	0.377	14,500	800	0.046	0.355	11,600	570	0.033	0.333	8,400	290	0.019	0.222
		8	19,000	1,290	0.060	0.169	16,200	900	0.051	0.160	13,000	690	0.041	0.150	10,400	490	0.029	0.141	7,800	260	0.017	0.094
		10	17,000	1,140	0.051	0.086	14,500	860	0.043	0.082	11,500	600	0.036	0.077	9,200	430	0.026	0.072	7,100	220	0.014	0.048
		12	15,300	990	0.043	0.050	13,000	710	0.036	0.048	10,000	500	0.030	0.045	8,000	360	0.022	0.042	6,500	180	0.012	0.028
		14	13,700	840	0.034	0.032	11,600	570	0.029	0.031	9,800	410	0.025	0.029	7,800	290	0.018	0.027	5,900	140	0.010	0.018
		16	11,900	680	0.026	0.022	10,100	350	0.022	0.020	9,100	310	0.020	0.019	7,300	220	0.014	0.018	5,300	110	0.008	0.012
		22	9,000	340	0.013	0.009	6,000	230	0.011	0.009	7,800	170	0.010	0.008	6,200	120	0.007	0.008	3,500	50	0.001	0.005
4015	**1.5**	6	19,800	1,520	0.080	0.527	16,800	1,200	0.068	0.498	14,300	840	0.054	0.469	11,400	600	0.039	0.440	8,200	310	0.022	0.293
		8	18,200	1,360	0.070	0.223	15,500	930	0.060	0.211	12,800	730	0.048	0.198	10,200	520	0.034	0.186	7,600	270	0.020	0.124
		10	16,600	1,200	0.060	0.113	14,100	900	0.051	0.107	11,300	630	0.042	0.101	9,000	450	0.030	0.095	7,000	230	0.017	0.063
		12	15,000	1,040	0.050	0.067	12,800	720	0.043	0.063	9,800	530	0.036	0.059	7,800	380	0.026	0.056	6,400	190	0.014	0.037
		14	13,400	880	0.040	0.041	11,400	600	0.034	0.039	9,500	420	0.030	0.037	7,600	300	0.021	0.035	5,800	150	0.012	0.023
		16	11,700	720	0.030	0.027	9,900	370	0.026	0.026	8,900	320	0.024	0.024	7,100	230	0.017	0.023	5,200	120	0.009	0.015
		18	10,100	560	0.020	0.020	9,600	310	0.017	0.019	8,400	240	0.017	0.018	6,700	170	0.012	0.017	4,600	80	0.007	0.011
		20	8,500	400	0.010	0.014	9,000	280	0.011	0.014	7,900	210	0.011	0.013	6,300	150	0.008	0.012	4,000	40	0.004	0.008
4016	**1.6**	6	19,200	1,670	0.080	0.682	15,100	1,320	0.068	0.644	13,900	920	0.054	0.606	11,100	660	0.039	0.569	8,000	340	0.022	0.379
		8	17,000	1,500	0.070	0.288	15,000	950	0.060	0.272	12,400	800	0.048	0.256	9,900	570	0.034	0.240	7,400	300	0.020	0.160
		10	16,100	1,320	0.060	0.148	12,700	930	0.051	0.139	10,900	700	0.042	0.131	8,700	500	0.030	0.123	6,800	250	0.017	0.082
		12	14,500	1,140	0.050	0.085	11,500	750	0.043	0.080	9,500	590	0.036	0.075	7,600	420	0.026	0.071	6,200	210	0.014	0.047
		14	13,000	970	0.040	0.054	10,300	660	0.034	0.051	9,100	460	0.030	0.048	7,300	330	0.021	0.045	5,600	170	0.012	0.030
		16	11,400	790	0.030	0.036	9,500	380	0.020	0.034	8,500	350	0.024	0.032	6,800	250	0.017	0.030	5,000	130	0.009	0.020
		18	9,800	620	0.020	0.025	9,300	340	0.017	0.024	8,000	250	0.017	0.022	6,400	180	0.012	0.021	4,500	80	0.007	0.014
		20	8,200	440	0.011	0.018	8,700	300	0.011	0.017	7,600	220	0.011	0.016	6,100	160	0.008	0.015	3,900	40	0.004	0.010
		26	8,000	300	0.007	0.009	7,400	210	0.006	0.009	6,600	170	0.006	0.008	5,300	120	0.004	0.008	2,400	20	0.002	0.005
4018	**1.8**	6	18,500	1,820	0.080	1.094	14,900	1,440	0.068	1.034	13,300	1,010	0.054	0.973	10,600	720	0.039	0.912	7,600	370	0.022	0.608
		8	16,900	1,630	0.070	0.461	14,600	980	0.060	0.435	11,900	870	0.048	0.410	9,500	620	0.034	0.384	7,100	320	0.020	0.256
		10	15,400	1,440	0.060	0.236	12,500	950	0.051	0.223	10,500	760	0.042	0.210	8,400	540	0.030	0.197	6,500	280	0.017	0.131
		12	13,900	1,250	0.050	0.137	11,000	770	0.043	0.129	9,100	640	0.036	0.122	7,300	460	0.026	0.114	6,000	230	0.014	0.076
		14	12,400	1,060	0.040	0.086	9,500	720	0.034	0.082	8,400	500	0.030	0.077	6,700	360	0.021	0.072	5,400	180	0.012	0.048
		16	10,900	860	0.030	0.058	9,000	450	0.026	0.054	7,900	390	0.024	0.051	6,300	280	0.017	0.048	4,800	140	0.009	0.032
		18	9,400	670	0.020	0.041	8,700	380	0.017	0.039	7,400	270	0.017	0.037	5,900	190	0.012	0.035	4,300	100	0.007	0.023
		20	7,900	480	0.015	0.029	8,400	340	0.013	0.027	7,000	240	0.011	0.026	5,600	170	0.008	0.024	3,700	50	0.004	0.016
		25	7,800	350	0.010	0.014	7,300	260	0.008	0.014	6,300	200	0.007	0.013	5,000	140	0.005	0.012	2,400	20	0.002	0.008

Milling Conditions for HLS (4 Flutes)

WORK MATERIAL			CARBON STEELS S45C / S50C (~225HB)				ALLOY STEELS SK / SCM / SUS (225~325HB)				PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC)				HARDENED STEELS SKD / SKT / STAVAX (45~55HRC)				HARDENED STEELS SKD / SKH (55~60HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4020	2	6	17,900	1,980	0.080	1.667	14,500	1,560	0.068	1.574	12,900	1,090	0.054	1.482	10,300	780	0.039	1.389	7,400	400	0.022	0.926
		8	16,400	1,770	0.070	0.704	14,200	1,000	0.060	0.665	11,500	950	0.048	0.626	9,200	680	0.034	0.587	6,800	350	0.020	0.391
		10	14,900	1,560	0.060	0.360	12,000	980	0.051	0.340	10,100	830	0.042	0.320	8,100	590	0.030	0.300	6,300	300	0.017	0.200
		12	13,500	1,350	0.050	0.209	10,500	790	0.043	0.197	8,800	690	0.036	0.186	7,000	490	0.026	0.174	5,800	250	0.014	0.116
		14	12,000	1,140	0.040	0.131	9,400	780	0.034	0.124	8,300	550	0.030	0.117	6,600	390	0.021	0.110	5,200	200	0.012	0.073
		16	10,600	940	0.030	0.088	9,000	500	0.026	0.083	7,600	420	0.024	0.078	6,100	300	0.017	0.074	4,700	160	0.009	0.049
		18	9,100	730	0.022	0.061	8,700	420	0.020	0.058	7,300	290	0.017	0.054	5,800	210	0.012	0.051	4,100	100	0.007	0.034
		20	7,700	520	0.018	0.045	8,100	380	0.016	0.043	6,900	270	0.013	0.040	5,500	190	0.009	0.038	3,600	50	0.004	0.025
		25	7,500	390	0.012	0.023	7,100	290	0.011	0.022	6,100	220	0.008	0.021	4,900	160	0.006	0.020	2,400	20	0.002	0.013
		30	7,000	310	0.008	0.013	6,300	230	0.007	0.012	5,600	180	0.006	0.011	4,500	130	0.004	0.011	2,400	10	0.001	0.007
4025	2.5	8					12,800	1,020	0.081	1.622	9,600	980	0.055	1.526	7,700	700	0.039	1.431	6,200	370	0.023	0.954
		12					10,000	810	0.056	0.481	7,900	700	0.042	0.453	6,300	500	0.030	0.425	5,600	350	0.018	0.283
		16					8,400	590	0.040	0.202	6,900	450	0.031	0.190	5,500	320	0.022	0.179	4,400	320	0.013	0.119
		20					7,300	490	0.030	0.104	6,500	420	0.024	0.098	5,200	300	0.017	0.092	3,500	290	0.010	0.061
		25					6,400	390	0.019	0.053	6,000	380	0.015	0.050	4,800	270	0.011	0.047	2,400	250	0.005	0.031
		30					5,700	320	0.012	0.031	4,400	350	0.010	0.029	3,500	250	0.007	0.027	2,300	220	0.003	0.018
4030	3	8					10,900	1,080	0.093	2.361	7,400	1,010	0.073	2.222	5,900	720	0.052	2.084	5,900	440	0.031	1.389
		12					8,700	830	0.073	0.996	7,000	730	0.057	0.938	5,600	520	0.041	0.879	5,000	400	0.024	0.586
		16					7,400	670	0.058	0.420	6,600	520	0.045	0.395	5,300	370	0.032	0.371	4,000	370	0.019	0.247
		20					6,600	560	0.045	0.216	6,100	490	0.035	0.203	4,900	350	0.025	0.191	3,400	340	0.015	0.127
		25					5,800	460	0.032	0.111	5,600	450	0.025	0.140	4,500	320	0.018	0.098	2,400	290	0.011	0.065
		30					5,200	390	0.023	0.065	4,300	410	0.020	0.061	3,400	290	0.014	0.057	2,300	250	0.009	0.038
		40					4,500	280	0.012	0.027	4,100	320	0.014	0.026	3,300	230	0.010	0.024	2,000	170	0.006	0.016
4040	4	12					7,100	950	0.101	3.148	5,100	740	0.101	2.963	4,100	530	0.072	2.778	4,100	460	0.043	1.852
		16					6,000	770	0.084	1.328	4,900	600	0.092	1.250	3,900	430	0.066	1.172	3,700	420	0.040	0.781
		20					5,200	650	0.069	0.680	4,500	560	0.084	0.640	3,600	400	0.060	0.600	3,300	380	0.036	0.400
		25					4,600	540	0.055	0.349	4,100	520	0.076	0.328	3,300	370	0.054	0.308	2,400	340	0.032	0.205
		30					4,100	460	0.043	0.202	3,800	460	0.059	0.190	3,000	330	0.042	0.179	2,300	290	0.027	0.119
		35					3,800	400	0.034	0.128	3,400	420	0.050	0.120	2,700	300	0.036	0.113	2,200	240	0.023	0.075
		40					3,500	350	0.027	0.085	3,000	380	0.042	0.080	2,400	270	0.030	0.075	1,900	190	0.018	0.050
		45					3,300	300	0.021	0.060	2,600	320	0.025	0.056	2,100	230	0.018	0.053	1,800	140	0.014	0.035
		50					3,100	270	0.016	0.044	2,300	280	0.017	0.042	1,800	200	0.012	0.039	1,700	100	0.009	0.026
4050	5	16					5,100	860	0.128	3.242	4,100	670	0.108	3.051	3,300	480	0.077	2.861	3,300	480	0.048	1.907
		25					3,800	600	0.102	0.850	3,600	570	0.088	0.800	2,900	410	0.063	0.750	2,400	380	0.037	0.500
		35					3,100	450	0.077	0.309	2,900	480	0.059	0.291	2,300	340	0.042	0.273	2,000	270	0.026	0.182
		50					2,400	300	0.034	0.107	2,000	320	0.022	0.101	1,600	230	0.016	0.095	1,500	110	0.010	0.063
4060	6	20					3,800	780	0.170	3.443	3,300	700	0.139	3.240	2,600	500	0.099	3.038	3,300	610	0.060	2.025
		30					2,800	540	0.128	1.020	2,800	590	0.101	0.960	2,200	420	0.072	0.900	2,200	360	0.045	0.600
		40					2,300	410	0.085	0.430	2,100	460	0.063	0.405	1,700	330	0.045	0.380	1,700	240	0.030	0.253
		50					1,900	310	0.049	0.221	1,600	350	0.038	0.208	1,300	250	0.027	0.195	1,300	120	0.015	0.130

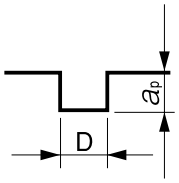
Recommend 2 flute HLS or C-CER.

Milling Conditions for HLS (4 Flutes)

Slotting

a_p : Axial Depth (mm)

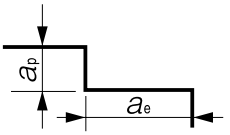
D : Outside Diameter (mm)



Side Milling

a_p : Axial Depth (mm)

a_e : Radial Depth (mm)



Note:

・Recommend using a non-contact measuring device to avoid damaging the precision tip point.
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Every coolant offers stable milling.
・Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
・Recommend wet coolant for Copper.

4 Flutes UTCOAT

Size **Ø6~Ø12**

CNRS

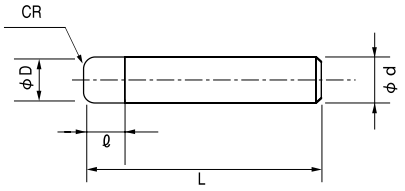
Super MG | UT COAT | 45° | R | R ±0.01 (Ø6) | R ±0.015 (Ø8~Ø12) | Shank Dia 0/-0.005 | Variable Pitch

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	◎			○	○		◎			☆	☆		

Features

4 flute high efficient corner radius designed for Titanium Alloys and Heat Resistant Alloys.
UTCOAT is recommended for heat-resistant hard materials to achieve longer tool life.
Variable pitch, high helix and positive rake angle offer stable milling.
Reduced cutting force when using a helical approach or inclined angles.



Total 12 models **Unit（mm）**

	Model Number	Outside Diameter ØD	Corner Radius CR	Length of Cut ℓ	Overall Length L	Shank Diameter Ød
※	**CNRS 4060-05-16**	6	R0.5	16	90	6
	CNRS 4060-10-16		R1		90	6
※	**CNRS 4080-05-16**	8	R0.5	16	100	8
	CNRS 4080-10-16		R1		100	8
※	**CNRS 4100-05-26**	10	R0.5	26	110	10
	CNRS 4100-10-26		R1		110	10
	CNRS 4100-15-26		R1.5		110	10
	CNRS 4100-20-26		R2		110	10
※	**CNRS 4120-05-26**	12	R0.5	26	120	12
	CNRS 4120-10-26		R1		120	12
	CNRS 4120-15-26		R1.5		120	12
	CNRS 4120-20-26		R2		120	12

※Additional model

Milling Conditions for CNRS

◆Side Milling

WORK MATERIAL			CARBON STEELS S45C / S50C				ALLOY STEELS SK / SCM				STAINLESS STEELS SUS			
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4060-05-16	**6**	R0.5	5,180	1,330	9.6	0.9	4,920	1,330	7.2	0.6	3,520	740	4.8	0.3
4060-10-16		R1	5,180	1,330	9.6	0.9	5,180	1,330	7.2	0.6	3,700	740	4.8	0.3
4080-05-16	**8**	R0.5	3,920	1,260	12.8	1.2	3,720	1,260	9.6	0.8	2,660	700	6.4	0.4
4080-10-16		R1	3,920	1,260	12.8	1.2	3,920	1,260	9.6	0.8	2,800	700	6.4	0.4
4100-05-26	**10**	R0.5	2,770	1,225	16	1.5	2,630	1,220	12	1	1,880	680	8	0.5
4100-10-26		R1	2,770	1,225	16	1.5	2,770	1,220	12	1	1,980	680	8	0.5
4100-15-26		R1.5	2,770	1,225	16	1.5	2,930	1,220	12	1	2,090	680	8	0.5
4100-20-26		R2	2,770	1,225	16	1.5	3,080	1,220	12	1	2,200	680	8	0.5
4120-05-26	**12**	R0.5	2,330	1,170	19.2	1.8	2,210	1,170	14.4	1.2	1,580	650	9.6	0.6
4120-10-26		R1	2,330	1,170	19.2	1.8	2,330	1,170	14.4	1.2	1,670	650	9.6	0.6
4120-15-26		R1.5	2,330	1,170	19.2	1.8	2,470	1,170	14.4	1.2	1,760	650	9.6	0.6
4120-20-26		R2	2,330	1,170	19.2	1.8	2,590	1,170	14.4	1.2	1,850	650	9.6	0.6

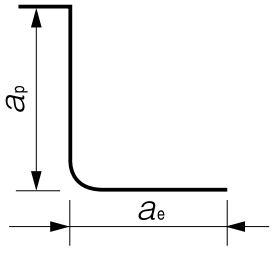
WORK MATERIAL			TITANIUM / TITANIUM ALLOYS Ti-6Al-4V				HEAT RESISTANT ALLOYS Inconel718			
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4060-05-16	**6**	R0.5	3,520	740	4.8	0.3	1,710	300	4.8	0.3
4060-10-16		R1	3,700	740	4.8	0.3	1,800	300	4.8	0.3
4080-05-16	**8**	R0.5	2,660	700	6.4	0.4	1,570	280	6.4	0.4
4080-10-16		R1	2,800	700	6.4	0.4	1,650	280	6.4	0.4
4100-05-26	**10**	R0.5	1,880	680	8	0.5	1,110	250	8	0.5
4100-10-26		R1	1,980	680	8	0.5	1,170	250	8	0.5
4100-15-26		R1.5	2,090	680	8	0.5	1,240	250	8	0.5
4100-20-26		R2	2,200	680	8	0.5	1,300	250	8	0.5
4120-05-26	**12**	R0.5	1,580	650	9.6	0.6	940	220	9.6	0.6
4120-10-26		R1	1,670	650	9.6	0.6	990	220	9.6	0.6
4120-15-26		R1.5	1,760	650	9.6	0.6	1,050	220	9.6	0.6
4120-20-26		R2	1,850	650	9.6	0.6	1,100	220	9.6	0.6

Please adjust milling parameters referring following table.

D : Ø 6 ~ Ø 12

Overhang Lengh	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
~D×4	×1	×1	×1	×1
~D×5	×0.7	×0.7	×0.7	×0.8
~D×6	×0.5	×0.5	×0.6	×0.7

Side Milling



a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

Milling Conditions for CNRS

◆Slotting

WORK MATERIAL			CARBON STEELS S45C / S50C			ALLOY STEELS SK / SCM			STAINLESS STEELS SUS		
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)
4060-05-16	6	R0.5	2,035	250	6	1,930	360	3	1,760	330	1.5
4060-10-16		R1	2,035	250	6	2,040	360	3	1,850	330	1.5
4080-05-16	8	R0.5	1,550	210	8	1,470	300	4	1,340	270	2
4080-10-16		R1	1,550	210	8	1,550	300	4	1,410	270	2
4100-05-26	10	R0.5	1,260	210	10	1,200	300	5	1,090	270	2.5
4100-10-26		R1	1,260	210	10	1,260	300	5	1,150	270	2.5
4100-15-26		R1.5	1,260	210	10	1,330	300	5	1,210	270	2.5
4100-20-26		R2	1,260	210	10	1,400	300	5	1,270	270	2.5
4120-05-26	12	R0.5	1,020	200	12	970	290	6	880	260	3
4120-10-26		R1	1,020	200	12	1,020	290	6	930	260	3
4120-15-26		R1.5	1,020	200	12	1,080	290	6	980	260	3
4120-20-26		R2	1,020	200	12	1,140	290	6	1,030	260	3

WORK MATERIAL			TITANIUM / TITANIUM ALLOYS Ti-6Al-4V			HEAT RESISTANT ALLOYS Inconel718		
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)
4060-05-16	6	R0.5	1,600	300	0.6	810	100	0.6
4060-10-16		R1	1,680	300	0.6	850	100	0.6
4080-05-16	8	R0.5	1,220	250	0.8	620	90	0.8
4080-10-16		R1	1,280	250	0.8	650	90	0.8
4100-05-26	10	R0.5	990	250	1	460	80	1
4100-10-26		R1	1,040	250	1	490	80	1
4100-15-26		R1.5	1,100	250	1	520	80	1
4100-20-26		R2	1,160	250	1	540	80	1
4120-05-26	12	R0.5	800	240	1.2	380	70	1.2
4120-10-26		R1	840	240	1.2	410	70	1.2
4120-15-26		R1.5	890	240	1.2	430	70	1.2
4120-20-26		R2	940	240	1.2	450	70	1.2

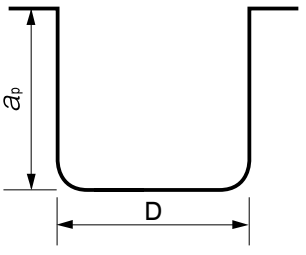
Please adjust milling parameters referring following table.

D : Ø 6 ~ Ø 12

Overhang Length	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
~D×4	×1	×1	×1	×1
~D×5	×0.7	×0.7	×0.7	×0.8
~D×6	×0.5	×0.5	×0.6	×0.7

Note:
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
- Recommend water soluble or oil coolant.

Slotting



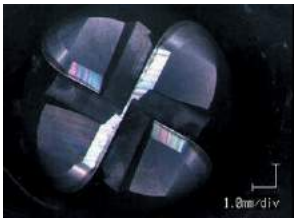
a_p : Axial Depth (mm)
D : Outside Diameter (mm)

Pocket Milling Example: Milling with CNRS Ø 10 × CR2

Ti6Al-4V（30HRC）

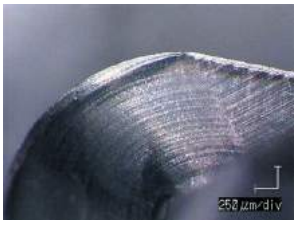
Stable milling on hard-to-cut materials

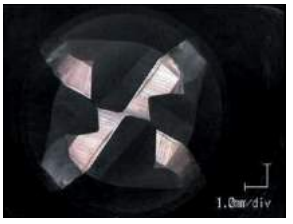
Spindle Speed	Feed Rate	Axial Depth	Radial Depth	Overhang Length	Cycle Time	Coolant	Pocket Size
1,820 min^{-1} V_c= 57 m/min	700 mm/min fz= 0.096 mm/t	0.5 mm	5 mm	45 mm (4.5D)	30 min	Water Soluble (Through Spindle)	70 × 44 × 13 mm



CNRS

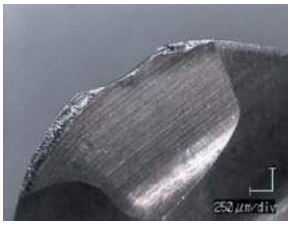
Continuous cutting is possible after 60 minutes milling.





Competitor's tool

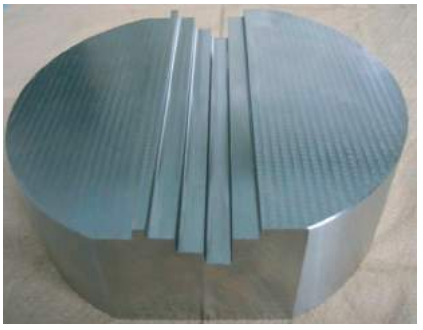
Corner radius is broken after 30min (one pocket) milling.



Slotting Example: Milling with CNRS Ø 8 × CR1

Inconel718（40HRC）

Milling Process	Roughing		Finishing
Milling Method	Slotting	Side Milling	
Spindle Speed	576 min^{-1} (V_c=14.5 m/min)	1,650 min^{-1} (V_c=41.5 m/min)	
Feed Rate	72 mm/min (fz=0.03 mm/t)	280 mm/min (fz=0.04 mm/t)	200 mm/min (fz=0.03 mm/t)
Axial Depth	0.8 mm	6.4 mm	0.1 mm
Radial Depth		0.4 mm	0.1 mm
Overhang Length	30 mm (3.75D)		
Coolant	Water Soluble (Nozzle)		
Cycle Time	105 min		10 min



Reduces burrs in step milling process.
Offers better surface finish with unique cutting edge.

4 Flutes UTCOAT

Size Ø4~Ø12

CXERS

NEW

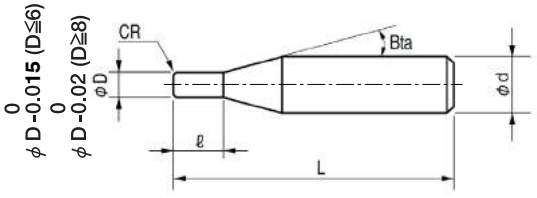
Super MG | UT COAT | 37°~40° | R | R ±0.01 (Ø4~Ø6) | R ±0.015 (Ø8~Ø12) | Shank Dia 0/-0.005 | Variable Pitch | Variable Helix

Material Applications (☆ Highly Recommended ◎Recommended ○Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	○			○			◎			○	○		

Features

Variable Division & Variable Helix design minimizes vibration and chattering.
Selected carbide material with high toughness & high chip resistance.
Excellent wear-resistance for the wide range of milling applications, from highly efficient milling to finishing.
Low friction coating resulting in excellent chip evacuation and resistance to wear.
Decreasing cutting resistance and offering stable milling by the original corner R design.



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 30 models Unit (mm)

Model Number	Outside Diameter ØD	Corner Radius CR	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
CXERS 4040-02-100	4	R0.2	10	16°	60	6
CXERS 4040-03-100		R0.3			60	6
CXERS 4040-05-100		R0.5			60	6
CXERS 4040-10-100		R1			60	6
CXERS 4050-02-125	5	R0.2	12.5	16°	60	6
CXERS 4050-03-125		R0.3			60	6
CXERS 4050-05-125		R0.5			60	6
CXERS 4050-10-125		R1			60	6
CXERS 4060-02-150	6	R0.2	15	-	60	6
CXERS 4060-03-150		R0.3			60	6
CXERS 4060-05-150		R0.5			60	6
CXERS 4060-10-150		R1			60	6

Unit（mm）

Model Number	Outside Diameter ØD	Corner Radius CR	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
CXERS 4080-02-200	8	R0.2	20	-	70	8
CXERS 4080-03-200		R0.3			70	8
CXERS 4080-05-200		R0.5			70	8
CXERS 4080-10-200		R1			70	8
CXERS 4080-15-200		R1.5			70	8
CXERS 4080-20-200		R2			70	8
CXERS 4100-02-250	10	R0.2	25	-	80	10
CXERS 4100-03-250		R0.3			80	10
CXERS 4100-05-250		R0.5			80	10
CXERS 4100-10-250		R1			80	10
CXERS 4100-15-250		R1.5			80	10
CXERS 4100-20-250		R2			80	10
CXERS 4120-02-300	12	R0.2	30	-	100	12
CXERS 4120-05-300		R0.5			100	12
CXERS 4120-10-300		R1			100	12
CXERS 4120-15-300		R1.5			100	12
CXERS 4120-20-300		R2			100	12
CXERS 4120-30-300		R3			100	12

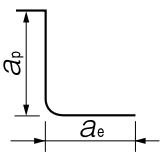
Milling Conditions for CXERS

◆Side Milling

WORK MATERIAL			CARBON STEELS S45C / S50C Annealed Materials (～225HB)				ALLOY STEELS SK / SCM Annealed Materials (225～325HB)				STAINLESS STEELS SUS304 ※ Use water soluble or oil coolant.			
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4040-02-100	4	R0.2	8,640	1,350	10	0.8	8,040	1,000	10	0.8	9,000	730	10	0.4
4040-03-100		R0.3	8,640	1,350	10	0.8	8,040	1,000	10	0.8	9,000	730	10	0.4
4040-05-100		R0.5	8,640	1,350	10	0.8	8,040	1,000	10	0.8	9,000	730	10	0.4
4040-10-100		R1	8,640	1,350	10	0.8	8,040	1,000	10	0.8	9,000	730	10	0.4
4050-02-125	5	R0.2	7,200	1,500	12.5	1	6,480	1,100	12.5	1	6,480	810	12.5	0.5
4050-03-125		R0.3	7,200	1,500	12.5	1	6,480	1,100	12.5	1	6,480	810	12.5	0.5
4050-05-125		R0.5	7,200	1,500	12.5	1	6,480	1,100	12.5	1	6,480	810	12.5	0.5
4050-10-125		R1	7,200	1,500	12.5	1	6,480	1,100	12.5	1	6,480	810	12.5	0.5
4060-02-150	6	R0.2	6,000	1,600	15	1.2	5,400	1,200	15	1.2	5,400	810	15	0.6
4060-03-150		R0.3	6,000	1,600	15	1.2	5,400	1,200	15	1.2	5,400	810	15	0.6
4060-05-150		R0.5	6,000	1,600	15	1.2	5,400	1,200	15	1.2	5,400	810	15	0.6
4060-10-150		R1	6,000	1,600	15	1.2	5,400	1,200	15	1.2	5,400	810	15	0.6
4080-02-200	8	R0.2	3,600	1,300	20	1.6	3,480	1,050	20	1.6	3,480	720	20	0.8
4080-03-200		R0.3	3,600	1,300	20	1.6	3,480	1,050	20	1.6	3,480	720	20	0.8
4080-05-200		R0.5	3,600	1,300	20	1.6	3,480	1,050	20	1.6	3,480	720	20	0.8
4080-10-200		R1	3,600	1,300	20	1.6	3,480	1,050	20	1.6	3,480	720	20	0.8
4080-15-200		R1.5	3,600	1,300	20	1.6	3,480	1,050	20	1.6	3,480	720	20	0.8
4080-20-200		R2	3,600	1,300	20	1.6	3,480	1,050	20	1.6	3,480	720	20	0.8
4100-02-250	10	R0.2	1,920	1,000	25	2	1,800	900	25	2	1,800	580	25	1
4100-03-250		R0.3	1,920	1,000	25	2	1,800	900	25	2	1,800	580	25	1
4100-05-250		R0.5	1,920	1,000	25	2	1,800	900	25	2	1,800	580	25	1
4100-10-250		R1	1,920	1,000	25	2	1,800	900	25	2	1,800	580	25	1
4100-15-250		R1.5	1,920	1,000	25	2	1,800	900	25	2	1,800	580	25	1
4100-20-250		R2	1,920	1,000	25	2	1,800	900	25	2	1,800	580	25	1
4120-02-300	12	R0.2	1,440	800	30	2.4	1,440	750	30	2.4	1,440	540	30	1.2
4120-05-300		R0.5	1,440	800	30	2.4	1,440	750	30	2.4	1,440	540	30	1.2
4120-10-300		R1	1,440	800	30	2.4	1,440	750	30	2.4	1,440	540	30	1.2
4120-15-300		R1.5	1,440	800	30	2.4	1,440	750	30	2.4	1,440	540	30	1.2
4120-20-300		R2	1,440	800	30	2.4	1,440	750	30	2.4	1,440	540	30	1.2
4120-30-300		R3	1,440	800	30	2.4	1,440	750	30	2.4	1,440	540	30	1.2
Milling Amount (mm)			a_p : All Flute a_e : 0.2D				a_p : All Flute a_e : 0.2D				a_p : All Flute a_e : 0.1D			

Milling Conditions for CXERS

WORK MATERIAL			PREHARDENED STEELS HPM/NAK (30～45HRC)				HARDENED STEELS SKD/SKT/STAVAX (45～55HRC)			
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4040-02-100	4	R0.2	7,080	650	10	0.8	4,700	520	10	0.4
4040-03-100		R0.3	7,080	650	10	0.8	4,700	520	10	0.4
4040-05-100		R0.5	7,080	650	10	0.8	4,700	520	10	0.4
4040-10-100		R1	7,080	650	10	0.8	4,700	520	10	0.4
4050-02-125	5	R0.2	5,760	680	12.5	1	3,850	530	12.5	0.5
4050-03-125		R0.3	5,760	680	12.5	1	3,850	530	12.5	0.5
4050-05-125		R0.5	5,760	680	12.5	1	3,850	530	12.5	0.5
4050-10-125		R1	5,760	680	12.5	1	3,850	530	12.5	0.5
4060-02-150	6	R0.2	4,800	680	15	1.2	3,200	540	15	0.6
4060-03-150		R0.3	4,800	680	15	1.2	3,200	540	15	0.6
4060-05-150		R0.5	4,800	680	15	1.2	3,200	540	15	0.6
4060-10-150		R1	4,800	680	15	1.2	3,200	540	15	0.6
4080-02-200	8	R0.2	3,000	600	20	1.6	2,000	500	20	0.8
4080-03-200		R0.3	3,000	600	20	1.6	2,000	500	20	0.8
4080-05-200		R0.5	3,000	600	20	1.6	2,000	500	20	0.8
4080-10-200		R1	3,000	600	20	1.6	2,000	500	20	0.8
4080-15-200		R1.5	3,000	600	20	1.6	2,000	500	20	0.8
4080-20-200		R2	3,000	600	20	1.6	2,000	500	20	0.8
4100-02-250	10	R0.2	1,800	430	25	2	1,200	450	25	1
4100-03-250		R0.3	1,800	430	25	2	1,200	450	25	1
4100-05-250		R0.5	1,800	430	25	2	1,200	450	25	1
4100-10-250		R1	1,800	430	25	2	1,200	450	25	1
4100-15-250		R1.5	1,800	430	25	2	1,200	450	25	1
4100-20-250		R2	1,800	430	25	2	1,200	450	25	1
4120-02-300	12	R0.2	1,200	320	30	2.4	960	420	30	1.2
4120-05-300		R0.5	1,200	320	30	2.4	960	420	30	1.2
4120-10-300		R1	1,200	320	30	2.4	960	420	30	1.2
4120-15-300		R1.5	1,200	320	30	2.4	960	420	30	1.2
4120-20-300		R2	1,200	320	30	2.4	960	420	30	1.2
4120-30-300		R3	1,200	320	30	2.4	960	420	30	1.2
Milling Amount (mm)			a_p : All Flute a_e : 0.2D				a_p : All Flute a_e : 0.1D			



Side Milling
a_p : Axial Depth (mm)
a_p : Radial Depth (mm)

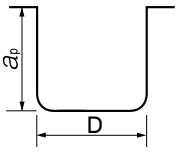
Milling Conditions for CXERS

◆Slotting

WORK MATERIAL			CARBON STEELS S45C / S50C Annealed Materials (～225HB)			ALLOY STEELS SK / SCM Annealed Materials (225～325HB)			STAINLESS STEELS SUS304 ※ Use water soluble or oil coolant.		
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)
4040-02-100	**4**	R0.2	8,640	650	4	8,040	450	4	9,000	400	2
4040-03-100		R0.3	8,640	650	4	8,040	450	4	9,000	400	2
4040-05-100		R0.5	8,640	650	4	8,040	450	4	9,000	400	2
4040-10-100		R1	8,640	650	4	8,040	450	4	9,000	400	2
4050-02-125	**5**	R0.2	7,200	700	5	6,480	500	5	6,480	460	2.5
4050-03-125		R0.3	7,200	700	5	6,480	500	5	6,480	460	2.5
4050-05-125		R0.5	7,200	700	5	6,480	500	5	6,480	460	2.5
4050-10-125		R1	7,200	700	5	6,480	500	5	6,480	460	2.5
4060-02-150	**6**	R0.2	6,000	700	6	5,400	500	6	5,400	460	3
4060-03-150		R0.3	6,000	700	6	5,400	500	6	5,400	460	3
4060-05-150		R0.5	6,000	700	6	5,400	500	6	5,400	460	3
4060-10-150		R1	6,000	700	6	5,400	500	6	5,400	460	3
4080-02-200	**8**	R0.2	3,600	500	8	3,480	360	8	3,480	340	4
4080-03-200		R0.3	3,600	500	8	3,480	360	8	3,480	340	4
4080-05-200		R0.5	3,600	500	8	3,480	360	8	3,480	340	4
4080-10-200		R1	3,600	500	8	3,480	360	8	3,480	340	4
4080-15-200		R1.5	3,600	500	8	3,480	360	8	3,480	340	4
4080-20-200		R2	3,600	500	8	3,480	360	8	3,480	340	4
4100-02-250	**10**	R0.2	1,920	380	10	1,800	270	10	1,800	220	5
4100-03-250		R0.3	1,920	380	10	1,800	270	10	1,800	220	5
4100-05-250		R0.5	1,920	380	10	1,800	270	10	1,800	220	5
4100-10-250		R1	1,920	380	10	1,800	270	10	1,800	220	5
4100-15-250		R1.5	1,920	380	10	1,800	270	10	1,800	220	5
4100-20-250		R2	1,920	380	10	1,800	270	10	1,800	220	5
4120-02-300	**12**	R0.2	1,440	300	12	1,440	210	12	1,440	180	6
4120-05-300		R0.5	1,440	300	12	1,440	210	12	1,440	180	6
4120-10-300		R1	1,440	300	12	1,440	210	12	1,440	180	6
4120-15-300		R1.5	1,440	300	12	1,440	210	12	1,440	180	6
4120-20-300		R2	1,440	300	12	1,440	210	12	1,440	180	6
4120-30-300		R3	1,440	300	12	1,440	210	12	1,440	180	6
Milling Amount (mm)			a_p : 1D			a_p : 1D			a_p : 0.5D		

Milling Conditions for CXERS

WORK MATERIAL			PREHARDENED STEELS HPM/NAK (30～45HRC)			HARDENED STEELS SKD/SKT/STAVAX (45～55HRC)		
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)
4040-02-100	**4**	R0.2	7,080	390	4	5,900	380	2
4040-03-100		R0.3	7,080	390	4	5,900	380	2
4040-05-100		R0.5	7,080	390	4	5,900	380	2
4040-10-100		R1	7,080	390	4	5,900	380	2
4050-02-125	**5**	R0.2	5,760	440	5	4,800	410	2.5
4050-03-125		R0.3	5,760	440	5	4,800	410	2.5
4050-05-125		R0.5	5,760	440	5	4,800	410	2.5
4050-10-125		R1	5,760	440	5	4,800	410	2.5
4060-02-150	**6**	R0.2	4,800	440	6	4,000	440	3
4060-03-150		R0.3	4,800	440	6	4,000	440	3
4060-05-150		R0.5	4,800	440	6	4,000	440	3
4060-10-150		R1	4,800	440	6	4,000	440	3
4080-02-200	**8**	R0.2	3,000	340	8	2,500	340	4
4080-03-200		R0.3	3,000	340	8	2,500	340	4
4080-05-200		R0.5	3,000	340	8	2,500	340	4
4080-10-200		R1	3,000	340	8	2,500	340	4
4080-15-200		R1.5	3,000	340	8	2,500	340	4
4080-20-200		R2	3,000	340	8	2,500	340	4
4100-02-250	**10**	R0.2	1,800	220	10	1,500	240	5
4100-03-250		R0.3	1,800	220	10	1,500	240	5
4100-05-250		R0.5	1,800	220	10	1,500	240	5
4100-10-250		R1	1,800	220	10	1,500	240	5
4100-15-250		R1.5	1,800	220	10	1,500	240	5
4100-20-250		R2	1,800	220	10	1,500	240	5
4120-02-300	**12**	R0.2	1,200	180	12	1,200	220	6
4120-05-300		R0.5	1,200	180	12	1,200	220	6
4120-10-300		R1	1,200	180	12	1,200	220	6
4120-15-300		R1.5	1,200	180	12	1,200	220	6
4120-20-300		R2	1,200	180	12	1,200	220	6
4120-30-300		R3	1,200	180	12	1,200	220	6
Milling Amount (mm)			a_p : 1D			a_p : 0.5D		



Slotting Milling
a_p : Axial Depth (mm)
D : Outside Diameter (mm)

Note:
- Decrease both spindle speed and feed rate proportionally in case of chattering.
- These milling parameters are calculated based on the shortest overhang length. Longer overhangs may require an adjustment to the milling parameters.
- Reduce the milling amount and feed rate in accordance with required milling precision.
- Every coolant offers stable milling.
- Recommend water soluble or oil coolant for Stainless Steels and Copper.

5 Flutes UTCOAT

Size **Ø3~Ø12**

CXRS

NEW

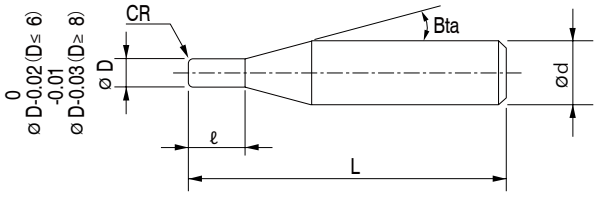
Super MG | UT COAT | 42°~45° | R | R ±0.01 (Ø3~Ø6) | R ±0.015 (Ø8~Ø12) | Shank Dia 0/-0.005 | Variable Pitch | Variable Helix

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	◎			○	○		◎			○	○		

Features

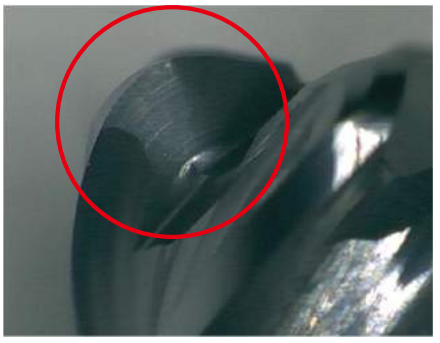
Recommended on a wide range of materials – Carbon Steels and Hardened steels up to 55 HRC.
Variable devision & helix design and positive rake angle offer highly efficient side milling.
Seamless corner radius design greatly reduces cutting force.



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Variable Pitch

Seamless Corner Radius



Variable Helix

Total 30 models

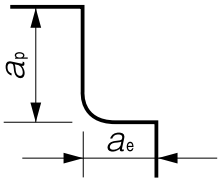
Unit（mm）

Model Number	Outside Diameter ØD	Corner Radius CR	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
CXRS 5030-05-0600	3	R0.5	6	16°	50	6
CXRS 5030-05-0900			9		50	6
CXRS 5040-05-0800	4	R0.5	8	16°	60	6
CXRS 5040-05-1200			12		60	6
CXRS 5040-10-0800		R1	8		60	6
CXRS 5040-10-1200			12		60	6
CXRS 5060-05-1200	6	R0.5	12	-	70	6
CXRS 5060-05-1800			18		70	6
CXRS 5060-10-1200		R1	12		70	6
CXRS 5060-10-1800			18		70	6
CXRS 5080-05-1600	8	R0.5	16	-	70	8
CXRS 5080-05-2400			24		70	8
CXRS 5080-10-1600		R1	16		70	8
CXRS 5080-10-2400			24		70	8
CXRS 5100-05-2000	10	R0.5	20	-	80	10
CXRS 5100-05-3000			30		80	10
CXRS 5100-10-2000		R1	20		80	10
CXRS 5100-10-3000			30		80	10
CXRS 5100-15-2000		R1.5	20	-	80	10
CXRS 5100-15-3000			30		80	10
CXRS 5100-20-2000		R2	20		80	10
CXRS 5100-20-3000			30		80	10
CXRS 5120-05-2400	12	R0.5	24	-	80	12
CXRS 5120-05-3600			36		100	12
CXRS 5120-10-2400		R1	24		80	12
CXRS 5120-10-3600			36		100	12
CXRS 5120-15-2400		R1.5	24		80	12
CXRS 5120-15-3600			36		100	12
CXRS 5120-20-2400		R2	24		80	12
CXRS 5120-20-3600			36		100	12

Milling Conditions for CXRS

WORK MATERIAL		CARBON STEELS S45C / S50C Annealed Materials (~225HB)				ALLOY STEELS SK / SCM Annealed Materials (225~325HB)				PREHARDENED STEELS HPM / NAK (30~45HRC)				HARDENED STEELS SKD / SKT / STAVAX (45~55HRC)			
Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
3	6	20,000	10,000	6	0.3	20,000	10,000	6	0.3	20,000	10,000	6	0.09	20,000	12,000	6	0.06
	9	20,000	6,000	8	0.24	20,000	6,000	8	0.24	20,000	6,400	8	0.09	20,000	12,000	8	0.05
4	8	18,200	9,100	8	0.4	18,200	9,100	8	0.4	19,800	9,900	8	0.12	15,000	11,500	8	0.08
	12	18,200	5,460	10.8	0.32	18,200	5,460	10.8	0.32	15,900	4,770	10.8	0.12	15,000	11,500	10.8	0.05
6	12	12,200	6,100	12	0.6	12,200	6,100	12	0.6	13,200	6,500	12	0.21	10,000	7,600	12	0.15
	18	12,200	5,100	16	0.48	12,200	5,100	16	0.48	12,000	5,000	16	0.18	10,000	7,600	16	0.1
8	16	9,100	4,550	16	0.8	9,100	4,550	16	0.8	9,900	4,950	16	0.4	7,600	5,600	16	0.2
	24	9,100	4,550	21	0.64	9,100	4,550	21	0.64	9,000	4,500	21	0.32	7,600	5,600	21	0.15
10	20	7,300	3,650	20	1	7,300	3,650	20	1	8,000	4,600	20	0.5	6,000	4,500	20	0.25
	30	7,300	3,650	27	0.8	7,300	3,650	27	0.8	7,300	3,650	27	0.4	6,000	4,500	27	0.22
12	24	6,100	3,050	24	1.2	6,100	3,050	24	1.2	6,600	3,960	24	0.6	5,000	3,800	24	0.3
	36	6,100	3,050	32	0.96	6,100	3,050	32	0.96	6,100	3,050	32	0.48	5,000	3,800	32	0.25

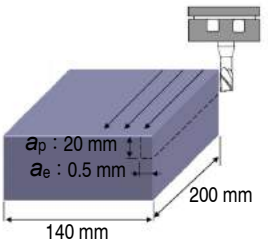
Note:
- Please be sure to use water soluble coolant.
- These milling parameters are for reference only.
- For best result, fine parameter adjustments may be required, depending on the milling shape / application / machine used and so on.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
- WARNING: Because of high material removal rate, you must pay attention to your chip and coolant management.



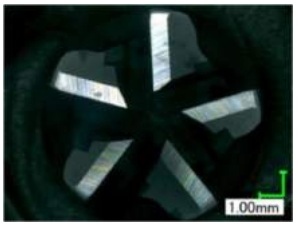
Side Milling
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

Milling Example 5 Flutes v.s. 4 Flutes Comparison of cutting chips

Work Material：STAVAX（53HRC）
Size：140 × 200 mm
Coolant：Oil Mist
Milling Method：Side milling
Spindle Speed：4,000 min^{-1}
Feed Rate：2,500 mm/min
a_p Axial Depth：20 mm
a_e Radial Depth：0.5 mm



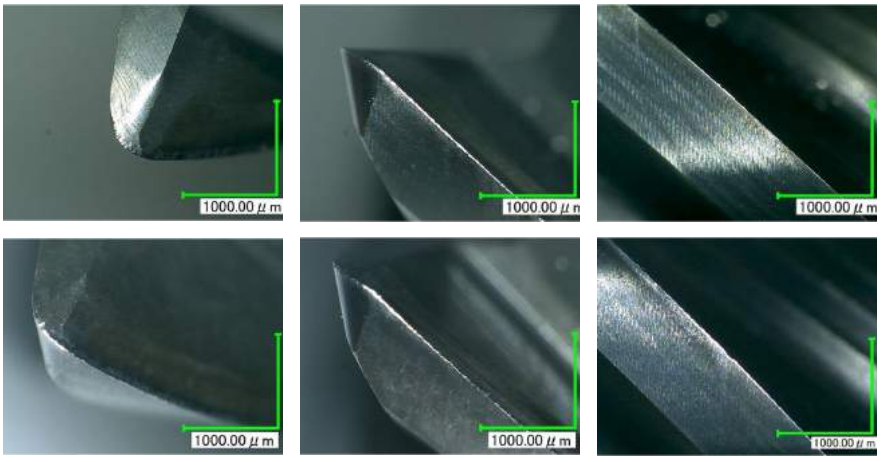
◆ 5 Flute Radius Ø 10 × CR0.5× Length of cut 20



After 40 min

After 80 min

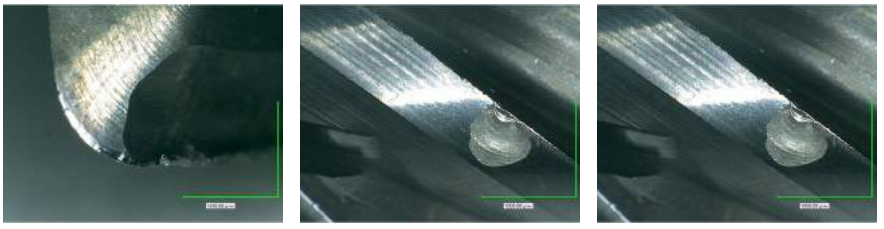
Rake face | Relief | Peripheral



◆ 4 Flute Radius Ø 10 × CR1× Length of cut 26

After 40 min

Rake face | Relief face | Peripheral cutting edge



◆ Comparison of cutting chips

5 Flutes
Uniform cutting chips

4 Flutes
Irregular size cutting chips

5 flutes, variable pitch and variable helix design protect the tool from chattering and chipping under high-speed condition.

Size Ø3~Ø12

HMERS

Super MG | HARD MAX | 45° | R | R ±0.01 | Shank Dia 0/-0.005

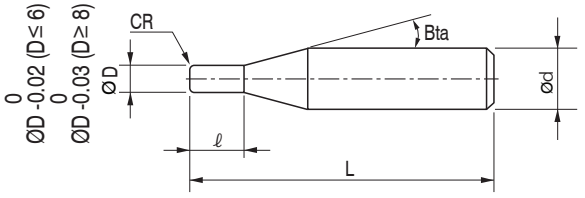
NEW

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS ~55HRC	HARDENED STEELS ~60HRC	HARDENED STEELS ~70HRC	CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE	HARD BRITTLE (NON-METALLIC) MATERIALS
		○	◎	◎	◎ ~65HRC										

Features

Radius End Mills for Hard Materials.
4 and 6 Flutes have been applied to suitable sizes to offer outstandingly long tool life.
HARDMAX coat enables highly efficient milling for 65HRC High Speed Steels.
Various Corner Radius sizes available.



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 37 models

Unit (mm)

Model Number	Outside Diameter ØD	Corner Radius CR	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Number of Flutes
HMERS 4030-01-075	3	R0.1	7.5	16°	60	6	4
HMERS 4030-02-075		R0.2			60	6	
HMERS 4030-03-075		R0.3			60	6	
HMERS 4030-05-075		R0.5			60	6	
HMERS 4040-01-100	4	R0.1	10	16°	60	6	4
HMERS 4040-02-100		R0.2			60	6	
HMERS 4040-03-100		R0.3			60	6	
HMERS 4040-05-100		R0.5			60	6	
HMERS 4040-10-100		R1			60	6	
HMERS 4050-01-125	5	R0.1	12.5	16°	90	6	4
HMERS 4050-02-125		R0.2			60	6	
HMERS 4050-03-125		R0.3			60	6	
HMERS 4050-05-125		R0.5			60	6	
HMERS 4050-10-125		R1			60	6	
HMERS 6060-01-130	6	R0.1	13	-	60	6	6
HMERS 6060-02-130		R0.2			60	6	
HMERS 6060-03-130		R0.3			60	6	
HMERS 6060-05-130		R0.5			60	6	
HMERS 6060-10-130		R1			60	6	
HMERS 6060-15-130		R1.5			60	6	
HMERS 6080-02-190	8	R0.2	19	-	70	8	6
HMERS 6080-03-190		R0.3			70	8	
HMERS 6080-05-190		R0.5			70	8	
HMERS 6080-10-190		R1			70	8	
HMERS 6080-20-190		R2			70	8	

4 Flutes ~ 6 Flutes HARDMAX

Unit（mm）

Model Number	Outside Diameter ØD	Corner Radius CR	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Number of Flutes
HMERS 6100-02-220	10	R0.2	22	-	80	10	6
HMERS 6100-03-220		R0.3			80	10	
HMERS 6100-05-220		R0.5			80	10	
HMERS 6100-10-220		R1			80	10	
HMERS 6100-15-220		R1.5			80	10	
HMERS 6100-20-220		R2			80	10	
HMERS 6120-02-260	12	R0.2	26	-	100	12	6
HMERS 6120-03-260		R0.3			100	12	
HMERS 6120-05-260		R0.5			100	12	
HMERS 6120-10-260		R1			100	12	
HMERS 6120-15-260		R1.5			100	12	
HMERS 6120-20-260		R2			100	12	

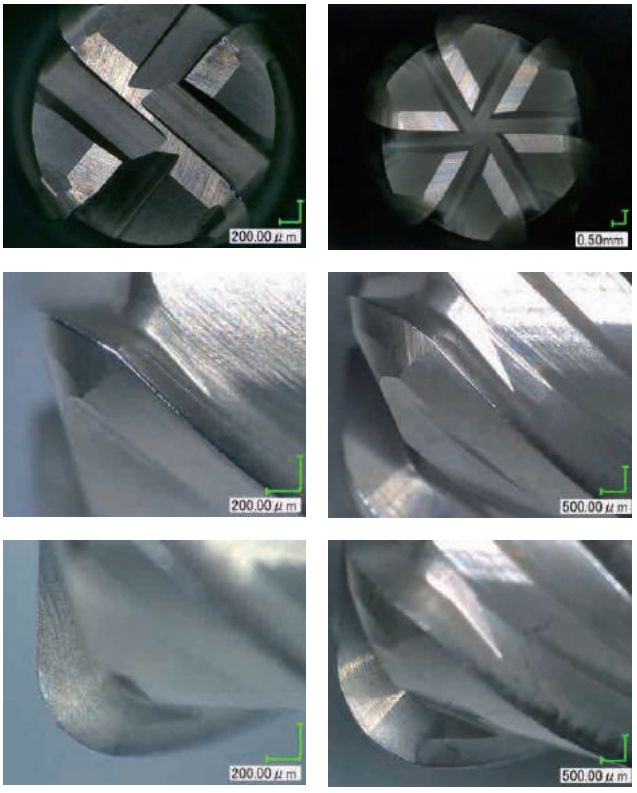
Side Milling Example

HMERS Ø3 × CR0.5 / Ø10 × CR2

SKH51 (63 HRC)

Tools After Milling

4030-05-075 **6100-20-220**

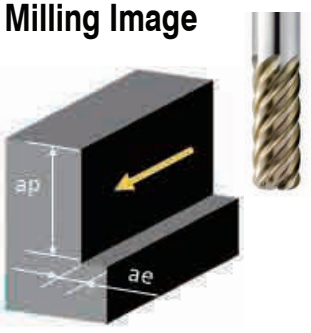


No chipping when milling Hard Materials

More tool life left

Tool	HMERS 4030-05-075 (Ø3 × CR0.5)	HMERS 6100-20-220 (Ø10 × CR2)
Spindle Speed	8,600 min^{-1}	2,580 min^{-1}
Feed Rate	465 mm/min	1,160 mm/min
Axial Depth a_p	6 mm	15 mm
Radial Depth a_e	0.06 mm	0.1 mm
Milling Distance	12.7 m	28 m
Coolant	Air Blow (Through Spindle)	

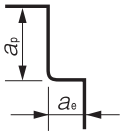
Milling Image



Side Milling (Down-cut)

HMERS Milling Conditions

WORK MATERIAL				PREHARDENED STEELS / HARDENED STEELS (40~50HRC)				HARDENED STEELS (50~60HRC)				HARDENED STEELS (60~65HRC)			
Model Number	Number of Flutes	Outside Diameter (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4030	**4**	3	7.5	13,100	1,680	6	0.06	4,200	720	6	0.06	8,600	465	6	0.06
4040	**4**	4	10	11,300	1,950	8	0.08	3,150	540	8	0.08	6,450	350	8	0.08
4050	**4**	5	12.5	10,100	2,300	10	0.1	2,520	430	10	0.1	5,160	280	10	0.1
6060	**6**	6	13	8,900	2,930	12	0.12	4,300	1,200	9	0.12	4,300	1,200	9	0.12
6080	**6**	8	19	4,000	2,400	12	0.24	3,220	1,450	12	0.08	3,220	1,450	12	0.08
6100	**6**	10	22	3,200	2,000	15	0.3	2,580	1,160	15	0.1	2,580	1,160	15	0.1
6120	**6**	12	26	2,670	1,600	18	0.36	2,150	970	18	0.12	2,150	970	18	0.12



Side Milling
a_p : Axial Depth (mm)
a_p : Radial Depth (mm)

Note
- Recommend down cut processing.
- Reduce cutting amount, feed rate, and apply zero-cut in accordance with required surface quality.
- Recommend air blow or oil mist.

Size Ø0.5~Ø1

CBN-LR

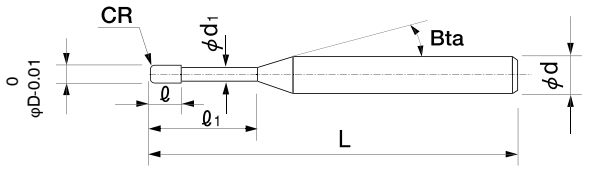
cBN | 0° | R | R ±0.003 CR0.02 | R ±0.005 CR0.05 | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
		○	◎	◎	◎ ~68HRC										

Features

cBN material offers better surface finish and longer tool life on ultra hard materials in comparison to solid carbide tools.



The shank taper angle shown is not an exact value and to avoid contact with the workpiece, we recommend the user controls the precise value of this angle.
Shank taper angle should not make contact with the work piece.

Total 16 models **Unit (mm)**

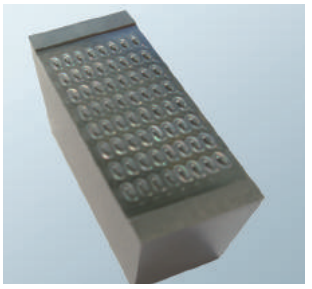
Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
CBN-LR 2005-002-010	0.5	0.02	1	0.3	0.47	11	45	4
CBN-LR 2005-002-015			1.5					
CBN-LR 2005-005-010		0.05	1					
CBN-LR 2005-005-015			1.5					
CBN-LR 2006-002-010	0.6	0.02	1		0.57			
CBN-LR 2006-002-015			1.5					
CBN-LR 2006-005-010		0.05	1					
CBN-LR 2006-005-015			1.5					
CBN-LR 2008-002-010	0.8	0.02	1	0.56	0.77			
CBN-LR 2008-002-020			2					
CBN-LR 2008-005-010		0.05	1					
CBN-LR 2008-005-020			2					
CBN-LR 2010-002-010	1	0.02	1	0.7	0.96			
CBN-LR 2010-002-020			2					
CBN-LR 2010-005-010		0.05	1					
CBN-LR 2010-005-020			2					

Milling Conditions for CBN-LR

Work Material	PREHARDENED STEELS/HARDENED STEELS NAK80 / STAVAX / ELMAX(～62HRC)				HARDENED STEELS YXR7(～68HRC)			
Outside Diameter	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
ø **0.5**	40,000	500	0.012	0.2	32,000	300	0.012	0.15
ø **0.6**	40,000	600	0.012	0.24	26,600	310	0.012	0.2
ø **0.8**	37,500	720	0.012	0.32	20,000	330	0.012	0.3
ø **1**	30,000	900	0.012	0.4	16,000	350	0.012	0.4

ELMAX(60HRC)　LED Mold Milling

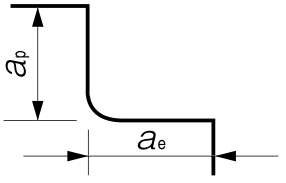
Tool	Milling Process	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Coolant	Cycle Time
2005-005-015	Finishing	45,000	500	0.006	0	Oil Mist	1h24m40s
2010-002-020	Finishing	45,000	500	0.001	0	Oil Mist	1h10m56s



HPM31(61HRC)　Slotting

Tool	Milling Process	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Coolant	Cycle Time
2005-005-010	Finishing	30,000	440	0.015	0.005	Oil Mist	2h7m

Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Recommend oil mist to avoid tool damage.



a_p : Axial Depth (mm)
a_e : Radial Depth (mm) = P_f

4 Flutes UTCOAT

Size Ø2~Ø12

CRRS

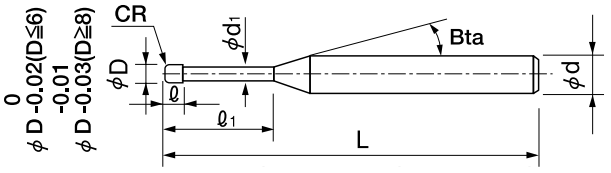
Super MG | UT COAT | 45° | R | R ±0.01 (Ø2~Ø6) | R ±0.015 (Ø8~Ø12) | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	◎			○	○		◎			◎	◎		

Features

Broad application range from Copper and Raw Materials to Hardened Steels (55HRC).
UTCOAT offers longer tool life milling Heat Resistant Alloys.
Variable pitch, high helix and positive rake angle offer stable milling.
Reduced cutting force when using a helical approach or inclined angles.



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 24 models Unit (mm)

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
CRRS 4020-05-06	2	R0.5	6	2	1.91	16°	70	4
CRRS 4030-08-09	3	R0.8	9	3	2.92	16°	70	6
CRRS 4040-03-12	4	R0.3	12	4	3.82	16°	60	6
CRRS 4040-05-12-4		R0.5				-	70	4
CRRS 4040-05-12						16°	60	6
CRRS 4040-10-12-4		R1.0				-	70	4
CRRS 4040-10-12						16°	70	6
CRRS 4050-12-15	5	R1.2	15	5	4.82	16°	70	6
CRRS 4060-03-18	6	R0.3	18	6	5.82	-	90	6
CRRS 4060-05-18		R0.5					60	6
CRRS 4060-10-18		R1.0					60	6
CRRS 4060-15-18		R1.5					90	6
CRRS 4080-03-24	8	R0.3	24	8	7.82	-	100	8
CRRS 4080-05-26		R0.5	26				70	8
CRRS 4080-10-26		R1.0					70	8
CRRS 4080-20-24		R2.0	24				100	8
CRRS 4100-03-30	10	R0.3	30	10	9.82	-	110	10
CRRS 4100-05-30		R0.5					80	10
CRRS 4100-10-30		R1.0					80	10
CRRS 4100-20-30		R2.0					110	10
CRRS 4120-03-36	12	R0.3	36	12	11.82	-	120	12
CRRS 4120-05-36		R0.5					120	12
CRRS 4120-10-36		R1.0					120	12
CRRS 4120-20-36		R2.0					120	12

Milling Conditions for CRRS

◆Roughing

WORK MATERIAL			CARBON STEELS S45C / S55C (~225HB)				ALLOY STEELS SK / SCM / SUS (225~325HB) *Use cutting oils for Stainless Steels.				PREHARDENED STEELS HARDENED STEELS NAK / HPM / SKD / SKT / STAVAX (30~55HRC) *Recommend oil mist.			
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4020-05-06	**2**	R0.5	30,000	7,200	0.08	0.8	30,000	7,200	0.04	0.66	24,000	7,000	0.02	0.59
4030-08-09	**3**	R0.8	20,000	8,400	0.09	1.2	20,000	7,200	0.04	1.08	16,000	7,000	0.04	0.88
4040-03-12	**4**	R0.3	15,000	9,600	0.09	1.6	15,000	7,200	0.05	1.32	12,000	7,000	0.05	1.17
4040-05-12-4		R0.5	15,000	9,600	0.1	1.6	15,000	7,200	0.05	1.35	12,000	7,000	0.05	1.26
4040-05-12			15,000	9,600	0.1	1.6	15,000	7,200	0.05	1.35	12,000	7,000	0.05	1.26
4040-10-12-4		R1	15,000	9,600	0.11	1.6	15,000	7,200	0.05	1.53	12,000	7,000	0.06	1.33
4040-10-12			15,000	9,600	0.11	1.6	15,000	7,200	0.05	1.53	12,000	7,000	0.06	1.33
4050-12-15	**5**	R1.2	12,000	10,800	0.13	2	12,000	7,200	0.06	1.8	9,600	6,300	0.06	1.54
4060-03-18	**6**	R0.3	10,000	12,000	0.13	2.4	10,000	7,200	0.07	1.94	8,000	5,250	0.07	1.63
4060-05-18		R0.5	10,000	12,000	0.14	2.4	10,000	7,200	0.07	1.98	8,000	5,250	0.07	1.75
4060-10-18		R1	10,000	12,000	0.15	2.4	10,000	7,200	0.07	2.16	8,000	5,250	0.08	1.75
4060-15-18		R1.5	10,000	12,000	0.17	2.4	10,000	7,200	0.08	2.34	8,000	5,250	0.11	1.75
4080-03-24	**8**	R0.3	7,500	12,000	0.17	2.86	7,500	7,200	0.08	2.76	6,000	4,100	0.15	1.77
4080-05-26		R0.5	7,500	12,000	0.18	2.64	7,500	7,200	0.08	2.61	6,000	4,100	0.14	1.76
4080-10-26		R1	7,500	12,000	0.18	2.72	7,500	7,200	0.09	2.7	6,000	4,100	0.16	1.76
4080-20-24		R2	7,500	12,000	0.22	2.88	7,500	7,200	0.1	2.79	6,000	4,100	0.18	1.96
4100-03-30	**10**	R0.3	6,000	12,000	0.2	3.04	5,000	5,400	0.14	2.82	4,800	4,100	0.18	1.89
4100-05-30		R0.5	6,000	12,000	0.22	3.04	5,000	5,400	0.14	2.88	4,800	4,100	0.18	2.03
4100-10-30		R1	6,000	12,000	0.24	3.28	5,000	5,400	0.14	2.97	4,800	4,100	0.19	2.1
4100-20-30		R2	6,000	12,000	0.26	3.44	5,000	5,400	0.14	3.06	4,800	4,100	0.2	2.45
4120-03-36	**12**	R0.3	5,000	12,000	0.21	3.32	3,000	4,320	0.18	2.9	4,000	4,100	0.19	2.15
4120-05-36		R0.5	5,000	12,000	0.24	3.32	3,000	4,320	0.18	2.96	4,000	4,100	0.19	2.32
4120-10-36		R1	5,000	12,000	0.26	3.59	3,000	4,320	0.18	3.06	4,000	4,100	0.2	2.4
4120-20-36		R2	5,000	12,000	0.28	3.76	3,000	4,320	0.18	3.15	4,000	4,100	0.21	2.8

WORK MATERIAL			TITANIUM / TITANIUM ALLOYS Ti-6Al-4V				HEAT RESISTANT ALLOYS Inconel718			
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4020-05-06	**2**	R0.5	21,420	4,010	0.03	0.33	5,140	810	0.03	0.33
4030-08-09	**3**	R0.8	14,280	4,010	0.03	0.54	3,430	810	0.03	0.54
4040-03-12	**4**	R0.3	10,710	4,010	0.04	0.66	2,570	810	0.04	0.66
4040-05-12-4		R0.5	10,710	4,010	0.04	0.68	2,570	810	0.04	0.68
4040-05-12			10,710	4,010	0.04	0.68	2,570	810	0.04	0.68
4040-10-12-4		R1	10,710	4,010	0.04	0.77	2,570	810	0.04	0.77
4040-10-12			10,710	4,010	0.04	0.77	2,570	810	0.04	0.77
4050-12-15	**5**	R1.2	8,570	4,010	0.04	0.9	2,060	810	0.04	0.9
4060-03-18	**6**	R0.3	7,140	4,010	0.05	1	1,740	810	0.05	1
4060-05-18		R0.5	7,140	4,010	0.05	1	1,730	810	0.05	1
4060-10-18		R1	7,140	4,010	0.05	1.08	1,740	810	0.05	1.08
4060-15-18		R1.5	7,140	4,010	0.05	1.08	1,740	810	0.05	1.08
4080-03-24	**8**	R0.3	5,360	4,000	0.05	1.28	1,580	800	0.05	1.28
4080-05-26		R0.5	5,360	4,000	0.05	1.31	1,580	800	0.05	1.31
4080-10-26		R1	5,360	4,000	0.05	1.35	1,580	800	0.05	1.35
4080-20-24		R2	5,360	4,000	0.05	1.4	1,580	800	0.05	1.4
4100-03-30	**10**	R0.3	3,570	3,010	0.09	1.41	1,050	550	0.09	1.41
4100-05-30		R0.5	3,570	3,010	0.09	1.44	1,050	550	0.09	1.44
4100-10-30		R1	3,570	3,010	0.09	1.49	1,050	550	0.09	1.49
4100-20-30		R2	3,570	3,010	0.09	1.53	1,050	550	0.09	1.53
4120-03-36	**12**	R0.3	2,140	2,400	0.12	1.45	640	410	0.12	1.45
4120-05-36		R0.5	2,140	2,400	0.12	1.48	640	410	0.12	1.48
4120-10-36		R1	2,140	2,400	0.12	1.53	640	410	0.12	1.53
4120-20-36		R2	2,140	2,400	0.12	1.58	640	410	0.12	1.58

Milling Conditions for CRRS

◆Finishing（Flat / Inclined surface）

WORK MATERIAL			CARBON STEELS S45C / S55C (～225HB)				ALLOY STEELS SK / SCM / SUS(225～325HB) *Use cutting oils for Stainless Steels.				PREHARDENED STEELS HARDENED STEELS NAK / HPM / SKD / SKT / STAVAX(30～55HRC) *Recommend oil mist.			
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4020-05-06	**2**	R0.5	30,000	1,720	0.1	0.06	30,000	1,510	0.05	0.05	24,000	1,070	0.05	0.04
4030-08-09	**3**	R0.8	20,000	1,890	0.1	0.09	20,000	1,660	0.05	0.08	16,000	1,160	0.05	0.07
4040-03-12	**4**	R0.3	15,000	1,050	0.1	0.07	15,000	910	0.05	0.06	12,000	620	0.05	0.05
4040-05-12-4		R0.5	15,000	1,360	0.1	0.09	15,000	1,180	0.05	0.08	12,000	810	0.05	0.07
4040-05-12			15,000	1,360	0.1	0.09	15,000	1,180	0.05	0.08	12,000	810	0.05	0.07
4040-10-12-4		R1	15,000	1,920	0.1	0.13	15,000	1,670	0.05	0.11	12,000	1,150	0.05	0.1
4040-10-12			15,000	1,920	0.1	0.13	15,000	1,670	0.05	0.11	12,000	1,150	0.05	0.1
4050-12-15	**5**	R1.2	12,000	1,910	0.1	0.16	12,000	1,630	0.05	0.14	9,600	1,120	0.05	0.12
4060-03-18	**6**	R0.3	10,000	890	0.2	0.09	10,000	760	0.1	0.08	8,000	510	0.1	0.06
4060-05-18		R0.5	10,000	1,150	0.2	0.12	10,000	990	0.1	0.1	8,000	670	0.1	0.08
4060-10-18		R1	10,000	1,630	0.2	0.16	10,000	1,400	0.1	0.14	8,000	950	0.1	0.12
4060-15-18		R1.5	10,000	2,000	0.2	0.2	10,000	1,720	0.1	0.17	8,000	1,170	0.1	0.15
4080-03-24	**8**	R0.3	7,500	1,170	0.2	0.11	7,500	1,050	0.1	0.09	6,000	720	0.1	0.08
4080-05-26		R0.5	7,500	990	0.2	0.13	7,500	860	0.1	0.11	6,000	580	0.1	0.1
4080-10-26		R1	7,500	1,410	0.2	0.19	7,500	1,210	0.1	0.16	6,000	830	0.1	0.14
4080-20-24		R2	7,500	1,990	0.2	0.27	7,500	1,720	0.1	0.23	6,000	1,170	0.1	0.2
4100-03-30	**10**	R0.3	6,000	720	0.2	0.12	5,000	510	0.1	0.1	4,800	400	0.1	0.08
4100-05-30		R0.5	6,000	940	0.2	0.16	5,000	660	0.1	0.13	4,800	520	0.1	0.11
4100-10-30		R1	6,000	1,330	0.2	0.22	5,000	940	0.1	0.19	4,800	740	0.1	0.15
4100-20-30		R2	6,000	1,890	0.2	0.32	5,000	1,340	0.1	0.27	4,800	1,050	0.1	0.22
4120-03-36	**12**	R0.3	5,000	680	0.2	0.14	3,000	330	0.1	0.1	4,000	360	0.1	0.09
4120-05-36		R0.5	5,000	880	0.2	0.18	3,000	430	0.1	0.14	4,000	480	0.1	0.12
4120-10-36		R1	5,000	1,240	0.2	0.24	3,000	610	0.1	0.2	4,000	680	0.1	0.16
4120-20-36		R2	5,000	1,760	0.2	0.35	3,000	870	0.1	0.29	4,000	960	0.1	0.24

WORK MATERIAL			TITANIUM / TITANIUM ALLOYS Ti-6Al-4V				HEAT RESISTANT ALLOYS Inconel718			
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4020-05-06	**2**	R0.5	21,420	840	0.04	0.03	5,140	170	0.04	0.03
4030-08-09	**3**	R0.8	14,280	920	0.04	0.04	3,430	190	0.04	0.04
4040-03-12	**4**	R0.3	10,710	510	0.04	0.03	2,570	100	0.04	0.03
4040-05-12-4		R0.5	10,710	660	0.04	0.04	2,570	130	0.04	0.04
4040-05-12			10,710	660	0.04	0.04	2,570	130	0.04	0.04
4040-10-12-4		R1	10,710	930	0.04	0.06	2,570	190	0.04	0.06
4040-10-12			10,710	930	0.04	0.06	2,570	190	0.04	0.06
4050-12-15	**5**	R1.2	8,570	910	0.03	0.07	2,060	180	0.03	0.07
4060-03-18	**6**	R0.3	7,140	420	0.07	0.04	1,740	90	0.07	0.04
4060-05-18		R0.5	7,140	550	0.07	0.05	1,730	110	0.07	0.05
4060-10-18		R1	7,140	780	0.07	0.07	1,740	160	0.07	0.07
4060-15-18		R1.5	7,140	960	0.06	0.08	1,740	190	0.06	0.08
4080-03-24	**8**	R0.3	5,360	400	0.06	0.04	1,580	80	0.06	0.04
4080-05-26		R0.5	5,360	480	0.06	0.06	1,580	100	0.06	0.06
4080-10-26		R1	5,360	670	0.06	0.08	1,580	130	0.06	0.08
4080-20-24		R2	5,360	960	0.05	0.12	1,580	190	0.05	0.12
4100-03-30	**10**	R0.3	3,570	280	0.06	0.05	1,050	50	0.06	0.05
4100-05-30		R0.5	3,570	370	0.06	0.07	1,050	70	0.06	0.07
4100-10-30		R1	3,570	520	0.06	0.1	1,050	100	0.06	0.1
4100-20-30		R2	3,570	750	0.06	0.14	1,050	140	0.06	0.14
4120-03-36	**12**	R0.3	2,140	240	0.07	0.05	640	40	0.07	0.05
4120-05-36		R0.5	2,140	310	0.07	0.07	640	50	0.07	0.07
4120-10-36		R1	2,140	400	0.07	0.11	640	70	0.07	0.12
4120-20-36		R2	2,140	520	0.07	0.17	640	100	0.07	0.17

Milling Conditions for CRRS

Please adjust milling parameter referring following table.

D : Outside Diameter (mm)
L : Overhang Length (mm)

D : Ø2.0～3.0

Overhang Length L/D	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
L/D≤ 6	×1	×1	×1	×1
L/D=7	×0.8	×0.8	×0.8	×0.9
L/D=8	×0.7	×0.7	×0.7	×0.9
L/D=9	×0.7	×0.7	×0.6	×0.8
L/D=10	×0.6	×0.6	×0.6	×0.7

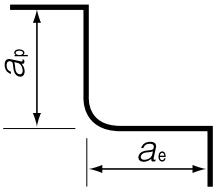
D : Ø4.0～6.0

Overhang Length L/D	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
L/D≤ 4	×1	×1	×1	×1
L/D=5	×0.9	×0.8	×0.9	×0.9
L/D=6	×0.8	×0.7	×0.8	×0.9
L/D=7	×0.7	×0.6	×0.6	×0.8
L/D=8	×0.5	×0.4	×0.6	×0.7

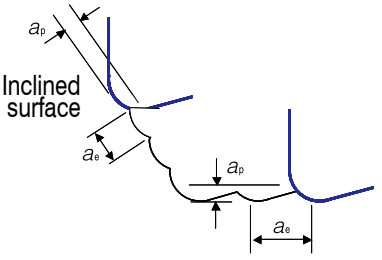
D : Ø8.0～12.0

Overhang Length L/D	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
L/D≤ 4	×1	×1	×1	×1
L/D=5	×0.7	×0.6	×0.6	×0.8
L/D=6	×0.5	×0.4	×0.5	×0.7

Roughing Parameter



Finishing Parameter
(Flat / Inclined surface)



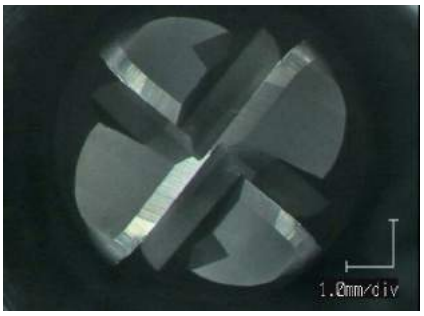
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Decrease the feed rate more than 50% from the milling parameters when slot milling.
・Only adjust the spindle speed when calculate milling conditions based on the overhang length in finishing process.
・Every coolant offers stable milling.
・Recommend wet coolant for Stainless Steels.

Tools After Milling by Different Work Materials CRRSØ 6 × CR0.5

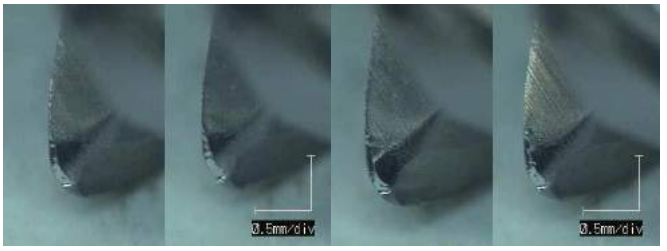
Spindle Speed	Feed Rate	Axial Depth	Radial Depth	Overhang Length	Cycle Time	Coolant
10,000 min^{-1}	12,000 mm/min	0.14 mm	2.4 mm	24 mm	90 min	Air Blow (Nozzle)

S50C



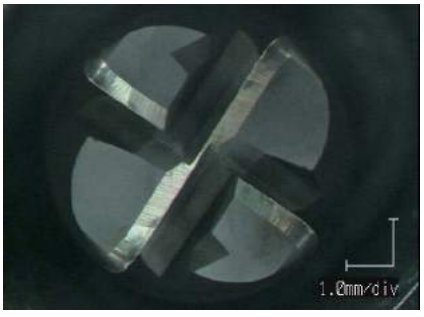
Flank wear

0.070 mm



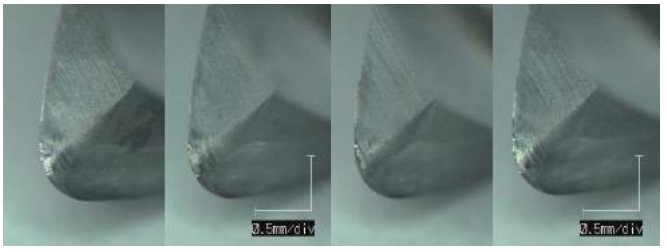
Spindle Speed	Feed Rate	Axial Depth	Radial Depth	Overhang Length	Cycle Time	Coolant
10,000 min^{-1}	7,200 mm/min	0.07 mm	1.98 mm	24 mm	84 min	Water Soluble

SUS304



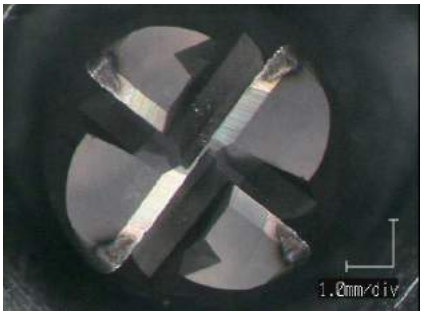
Flank wear

0.032 mm



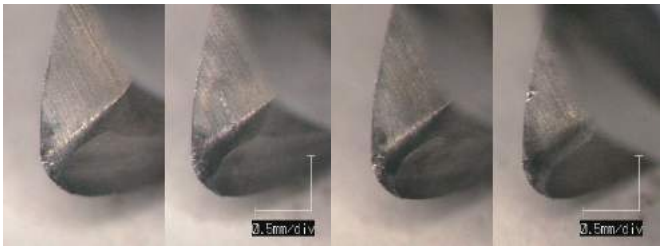
Spindle Speed	Feed Rate	Axial Depth	Radial Depth	Overhang Length	Cycle Time	Coolant
8,000 min^{-1}	5,250 mm/min	0.07 mm	1.75 mm	24 mm	56 min	Oil Mist

STAVAX (52HRC)



Flank wear

0.087 mm



Size **Ø3~Ø12**

CXLRS

NEW

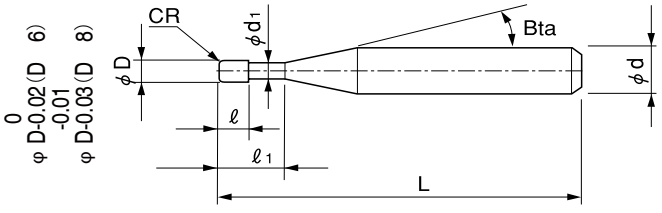
Super MG | UT COAT | 42°~45° | R | R ±0.01 (Ø3~Ø6) | R ±0.015 (Ø8~Ø12) | Shank Dia 0/-0.005 | Variable Pitch | Variable Helix

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	◎			○	○		◎			○	○		

Features

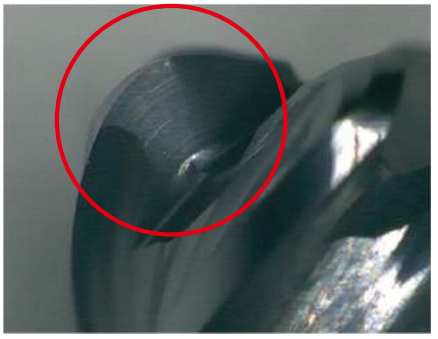
Broad application range from Carbon Steels to Hardened Steels (55HRC).
Variable pitch, variable helix and positive rake angle design offers highly efficient side milling.
Seamless Corner Radius design reduces cutting resistance.



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Variable Pitch

Seamless Corner Radius



Variable Helix

Total 30 models

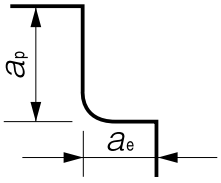
Unit（mm）

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
CXLRS 5030-05-09	3	R0.5	9	6	2.95	16°	50	6
CXLRS 5030-05-12			12				50	6
CXLRS 5040-05-12	4	R0.5	12	8	3.85	16°	60	6
CXLRS 5040-05-16			16				60	6
CXLRS 5040-10-12		R1	12				60	6
CXLRS 5040-10-16			16				60	6
CXLRS 5060-05-18	6	R0.5	18	12	5.85	-	70	6
CXLRS 5060-05-24			24				70	6
CXLRS 5060-10-18		R1	18				70	6
CXLRS 5060-10-24			24				70	6
CXLRS 5080-05-24	8	R0.5	24	16	7.8	-	70	8
CXLRS 5080-05-32			32				70	8
CXLRS 5080-10-24		R1	24				70	8
CXLRS 5080-10-32			32				70	8
CXLRS 5100-05-30	10	R0.5	30	20	9.8	-	80	10
CXLRS 5100-05-40			40				80	10
CXLRS 5100-10-30		R1	30				80	10
CXLRS 5100-10-40			40				80	10
CXLRS 5100-15-30		R1.5	30				80	10
CXLRS 5100-15-40			40				80	10
CXLRS 5100-20-30		R2	30				80	10
CXLRS 5100-20-40			40				80	10
CXLRS 5120-05-36	12	R0.5	36	24	11.8	-	80	12
CXLRS 5120-05-48			48				100	12
CXLRS 5120-10-36		R1	36				80	12
CXLRS 5120-10-48			48				100	12
CXLRS 5120-15-36		R1.5	36				80	12
CXLRS 5120-15-48			48				100	12
CXLRS 5120-20-36		R2	36				80	12
CXLRS 5120-20-48			48				100	12

Milling Conditions for CXLRS

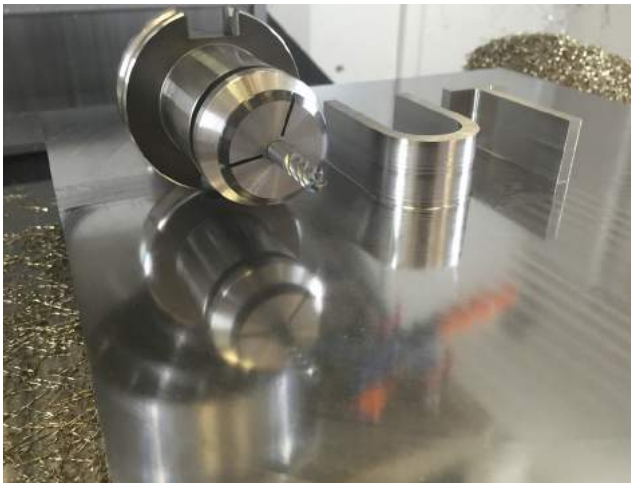
WORK MATERIAL		CARBON STEELS S45C / S50C Annealed Materials (～225HB)				ALLOY STEELS SK / SCM Annealed Materials (225～325HB)				PREHARDENED STEELS HPM / NAK (30～45HRC)				HARDENED STEELS SKD / SKT / STAVAX (45～55HRC)			
Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
3	9	20,000	6,000	6	0.24	20,000	6,000	6	0.24	20,000	6,400	6	0.09	20,000	12,000	6	0.05
	12	20,000	6,000	6	0.19	20,000	6,000	6	0.19	20,000	6,400	6	0.07	20,000	12,000	6	0.04
4	12	18,200	5,460	8	0.32	18,200	5,460	8	0.32	15,900	4,770	8	0.12	15,000	11,500	8	0.05
	16	18,200	5,460	8	0.26	18,200	5,460	8	0.26	15,900	4,770	8	0.1	15,000	11,500	8	0.04
6	18	12,200	5,100	12	0.48	12,200	5,100	12	0.48	12,000	5,000	12	0.18	10,000	7,600	12	0.1
	24	12,200	5,100	12	0.38	12,200	5,100	12	0.38	12,000	5,000	12	0.14	10,000	7,600	12	0.08
8	24	9,100	4,550	16	0.64	9,100	4,550	16	0.64	9,000	4,500	16	0.32	7,600	5,600	16	0.15
	32	9,100	4,550	16	0.51	9,100	4,550	16	0.51	9,000	4,500	16	0.26	7,600	5,600	16	0.12
10	30	7,300	3,650	20	0.8	7,300	3,650	20	0.8	7,300	3,650	20	0.4	6,000	4,500	20	0.22
	40	7,300	3,650	20	0.64	7,300	3,650	20	0.64	7,300	3,650	20	0.32	6,000	4,500	20	0.176
12	36	6,100	3,050	24	0.96	6,100	3,050	24	0.96	6,100	3,050	24	0.48	5,000	3,800	24	0.25
	48	6,100	3,050	24	0.77	6,100	3,050	24	0.77	6,100	3,050	24	0.38	5,000	3,800	24	0.2

Note:
- Please be sure to use water soluble coolant.
- These milling parameters are for reference only. For best result, fine parameter adjustments may be required, depending on the milling shape / application / machine used and so on.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
- WARNING: Because of high material removal rate, you must pay attention to your chip and coolant management.



Side Milling
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

Milling Example　CXLRS 5060-05-24（∅6 x CR0.5 x Effective Length 24 mm）
Work Material : RAMAX（32HRC）



Work Material：RAMAX（32HRC）
Size：500 x 500 mm
Coolant：Air Blow
Milling Method：Vortex（Trochoid）

Spindle Speed：14,000 min^{-1}
Feed Rate：7,000 mm/min
a_p Axial Depth：12 mm
a_e Radial Depth：0.5 mm

Roughing Video
RAMAX（32HRC）

Size **Ø6~Ø12**

HHRS

Super MG | HARD MAX | 45° | R | R ±0.01 Ø6 | R ±0.015 Ø8~Ø12 | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
○	○	◎	◎	○		○			○			○	○		

Features

Long neck radius design for milling on Hard Materials.
High rigid 6 flute radius end mills.

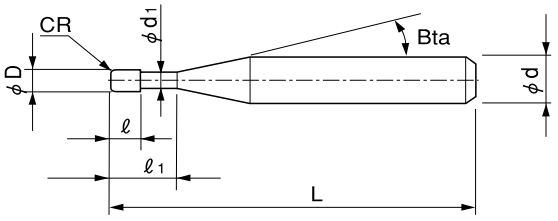


Photo of the tip

The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 14 models Unit (mm)

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HHRS 6060-01-210	6	R0.1	21	6	5.95	-	60	6
HHRS 6060-02-210		R0.2					60	6
HHRS 6060-03-210		R0.3					60	6
HHRS 6060-05-210		R0.5					60	6
HHRS 6060-10-210		R1					60	6
HHRS 6080-03-260	8	R0.3	26	8	7.81	-	80	8
HHRS 6080-05-260		R0.5					80	8
HHRS 6080-10-260		R1					80	8
HHRS 6100-03-310	10	R0.3	31	10	9.81	-	80	10
HHRS 6100-05-310		R0.5					80	10
HHRS 6100-10-310		R1					80	10
HHRS 6120-03-370	12	R0.3	37	12	11.81	-	100	12
HHRS 6120-05-370		R0.5					100	12
HHRS 6120-10-370		R1					100	12

Milling Conditions for HHRS

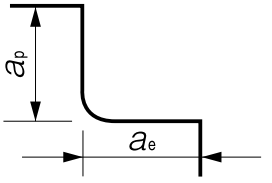
Side Milling

WORK MATERIAL	CARBON STEELS S45C / S50C		ALLOY STEELS SK / SCM / SUS		PREHARDENED STEELS HARDENED STEELS (30~45HRC)		HARDENED STEELS (45~55HRC)		HARDENED STEELS (55~65HRC)	
Outside Diameter (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)
6	6,300	2,650	6,300	2,650	6,300	2,650	4,800	2,000	3,200	1,600
8	4,750	2,650	4,750	2,650	4,750	2,650	3,600	2,000	2,400	1,600
10	3,800	2,650	3,800	2,650	3,800	2,650	2,850	2,000	2,000	1,600
12	3,150	2,650	3,150	2,650	3,150	2,650	2,400	2,000	1,600	1,600
Milling Amount (mm)	a_p:1D a_e:0.04D		a_p:1D a_e:0.04D		a_p:1D a_e:0.04D		a_p:0.8D a_e:0.02D		a_p:0.5D a_e:0.01D	

Bottom Surface Milling

WORK MATERIAL	CARBON STEELS S45C / S50C		ALLOY STEELS SK / SCM / SUS		PREHARDENED STEELS HARDENED STEELS (30~45HRC)		HARDENED STEELS (45~55HRC)		HARDENED STEELS (55~65HRC)	
Outside Diameter (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)
6	6,300	2,650	6,300	2,650	6,300	2,650	4,800	2,000	3,200	1,600
8	4,750	2,650	4,750	2,650	4,750	2,650	3,600	2,000	2,400	1,600
10	3,800	2,650	3,800	2,650	3,800	2,650	2,850	2,000	2,000	1,600
12	3,150	2,650	3,150	2,650	3,150	2,650	2,400	2,000	1,600	1,600
Milling Amount (mm)	a_p:0.02D a_e:0.2D		a_p:0.02D a_e:0.2D		a_p:0.02D a_e:0.2D		a_p:0.015D a_e:0.2D		a_p:0.01D a_e:0.2D	

Note:
- If the milling parameters have exceeded the machine's spindle speed capacity, or when the tool is chattering and heats up to a red color, reduce both the spindle speed and feed rates proportionally.
- When milling on a side or bottom surface, set the ap amount taking into consideration the remaining corner area.
- Recommend wet coolant for Stainless Steels.



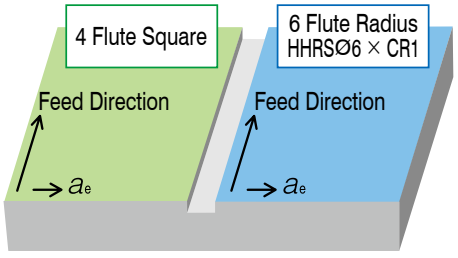
D : Outside Diameter (mm)
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

Bottom Surface Milling Comparison between HHRS & 4 Flute Square — End Mills — NAK80 (40HRC)

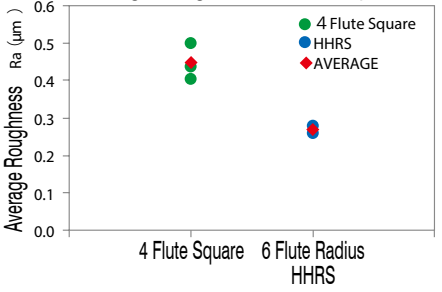
Better bottom surface roughness compared to 4 flute square type.

Spindle Speed	Feed Rate	Axial Depth	Radial Depth	Overhang Length	Coolant
6,300 min^{-1}	2,650 mm/min	0.12 mm	1.2 mm	22 mm	Air blow (Nozzle)

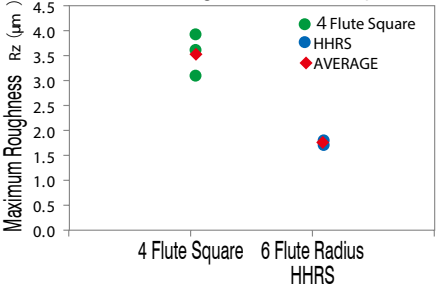
Milling Shape



Average Roughness (Ra) Comparison



Maximum Roughness (Rz) Comparison



Size Ø0.2~Ø6

HLRS2000/HLRS2000E

Material Applications (☆Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
○	○	◎	◎	◎	○ ~65HRC	○			◎			○	○		

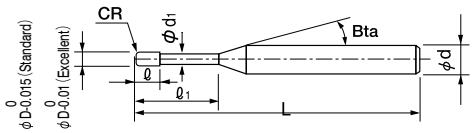
Total 353 models

Model Number	Excellent	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HLRS 2002-005-005E	○	0.2	R0.05	0.5	0.2	0.17	16°	50	4
HLRS 2002-005-010E	○			1				50	4
HLRS 2002-005-015E	○			1.5				50	4
HLRS 2002-005-020E	○			2				50	4
HLRS 2003-005-010E	○	0.3	R0.05	1	0.3	0.27	16°	50	4
HLRS 2003-005-015E	○			1.5				50	4
HLRS 2003-005-020E	○			2				50	4
HLRS 2003-005-025E	○			2.5				50	4
HLRS 2003-005-030E	○			3				50	4
HLRS 2004-005-010E	○	0.4	R0.05	1	0.4	0.38	16°	50	4
HLRS 2004-005-015E	○			1.5				50	4
HLRS 2004-005-020E	○			2				50	4
HLRS 2004-005-030E	○			3				50	4
HLRS 2004-005-040E	○			4				50	4
HLRS 2004-01-010			R0.1	1				50	4
HLRS 2004-01-015				2				50	4
HLRS 2004-01-020				2				50	4
HLRS 2004-01-030				3				50	4
HLRS 2004-01-040				4				50	4
HLRS 2005-005-010		0.5	R0.05	1	0.5	0.48	16°	50	4
HLRS 2005-005-020				2				50	4
HLRS 2005-005-030				3				50	4
HLRS 2005-005-040				4				50	4
HLRS 2005-005-050				5				50	4
HLRS 2005-01-010			R0.1	1				50	4
HLRS 2005-01-020				2				50	4
HLRS 2005-01-030				3				50	4
HLRS 2005-01-040				4				50	4
HLRS 2005-01-050				5				50	4
HLRS 2005-01-060				6				50	4

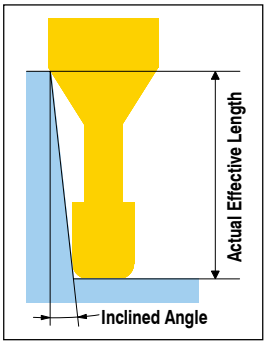
Next Page ➡

Features

Long Neck Radius design for high efficiency and high quality milling.
Recommended for various applications from Copper and Raw Materials to Hard Materials.
Both dry and wet coolant offer stable and long tool life.
Refer to page 308 for 4 flute HLRS.



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.



	Diameter Tolerance	Corner Radius Tolerance
Standard Tolerance Type	0/-0.015	Nominal Radius ± 0.005
Excellent Tolerance Type	0/-0.01	Nominal Radius ± 0.005

Unit（mm）

Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
			30'	1°	1°30'	2°	3°
HLRS 2002-005-005E	0.2	4	0.67	0.71	0.75	0.78	0.85
HLRS 2002-005-010E		4	1.20	1.26	1.31	1.36	1.45
HLRS 2002-005-015E		4	1.72	1.80	1.87	1.92	2.03
HLRS 2002-005-020E		4	2.25	2.34	2.41	2.48	2.59
HLRS 2003-005-010E	0.3	4	1.24	1.31	1.38	1.44	1.55
HLRS 2003-005-015E		4	1.72	1.83	1.91	1.99	2.12
HLRS 2003-005-020E		4	2.26	2.37	2.47	2.55	2.70
HLRS 2003-005-025E		4	2.78	2.91	3.02	3.11	3.27
HLRS 2003-005-030E		4	3.31	3.45	3.57	3.66	3.83
HLRS 2004-005-010E	0.4	4	1.31	1.40	1.49	1.57	1.72
HLRS 2004-005-015E		4	1.79	1.92	2.03	2.13	2.31
HLRS 2004-005-020E		4	2.33	2.48	2.60	2.71	2.90
HLRS 2004-005-030E		4	3.40	3.58	3.72	3.85	4.07
HLRS 2004-005-040E		4	4.45	4.66	4.82	4.97	5.21
HLRS 2004-01-010		4	1.28	1.38	1.46	1.55	1.69
HLRS 2004-01-015		4	1.76	1.90	2.01	2.11	2.28
HLRS 2004-01-020		4	2.30	2.46	2.58	2.69	2.89
HLRS 2004-01-030		4	3.38	3.56	3.71	3.83	4.06
HLRS 2004-01-040		4	4.44	4.64	4.81	4.95	5.20
HLRS 2005-005-010	0.5	4	1.34	1.46	1.57	1.67	1.86
HLRS 2005-005-020		4	2.37	2.55	2.71	2.84	3.08
HLRS 2005-005-030		4	3.45	3.67	3.85	4.00	4.27
HLRS 2005-005-040		4	4.52	4.77	4.97	5.14	5.44
HLRS 2005-005-050		4	5.58	5.85	6.07	6.26	6.58
HLRS 2005-01-010		4	1.34	1.45	1.56	1.66	1.85
HLRS 2005-01-020		4	2.37	2.55	2.70	2.83	3.07
HLRS 2005-01-030		4	3.45	3.67	3.84	4.00	4.26
HLRS 2005-01-040		4	4.52	4.76	4.96	5.13	5.43
HLRS 2005-01-050		4	5.58	5.85	6.07	6.25	6.57
HLRS 2005-01-060		4	6.63	6.93	7.16	7.36	7.70

Next Page ➡

2 Flutes HARDMAX

Model Number	Excellent	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HLRS 2006-005-020		0.6	R0.05	2	0.6	0.58	16°	50	4
HLRS 2006-005-030				3				50	4
HLRS 2006-005-040				4				50	4
HLRS 2006-005-060				6				50	4
HLRS 2006-005-080				8				50	4
HLRS 2006-01-020			R0.1	2				50	4
HLRS 2006-01-020E	○			2				50	4
HLRS 2006-01-030				3				50	4
HLRS 2006-01-030E	○			3				50	4
HLRS 2006-01-040				4				50	4
HLRS 2006-01-040E	○			4				50	4
HLRS 2006-01-060				6				50	4
HLRS 2006-01-080				8				50	4
HLRS 2006-02-020			R0.2	2				50	4
HLRS 2006-02-030				3				50	4
HLRS 2006-02-040				4				50	4
HLRS 2006-02-060				6				50	4
HLRS 2006-02-080				8				50	4
HLRS 2007-01-040		0.7	R0.1	4	0.7	0.68	16°	50	4
HLRS 2007-01-060				6				50	4
※ HLRS 2007-02-040			R0.2	4				50	4
※ HLRS 2007-02-060				6				50	4
HLRS 2008-005-060		0.8	R0.05	4	0.8	0.78	16°	50	4
HLRS 2008-005-060				6				50	4
HLRS 2008-005-080				8				50	4
HLRS 2008-01-040			R0.1	4				50	4
HLRS 2008-01-060				6				50	4
HLRS 2008-01-080				8				50	4
HLRS 2008-02-040			R0.2	4				50	4
HLRS 2008-02-060				6				50	4
HLRS 2008-02-080				8				50	4
HLRS 2010-005-020		1	R0.05					50	4
HLRS 2010-005-030				3				50	4
HLRS 2010-005-040				4				50	4
HLRS 2010-005-050				5				50	4
HLRS 2010-005-060				6				50	4
HLRS 2010-005-080				8				50	4
HLRS 2010-005-100				10				50	4
HLRS 2010-005-120				12				55	4
HLRS 2010-005-160				16				60	4
HLRS 2010-005-200				20				60	4
HLRS 2010-01-020			R0.1	2				50	4
HLRS 2010-01-020E	○			2				50	4
HLRS 2010-01-030				3				50	4
HLRS 2010-01-040				4				50	4
HLRS 2010-01-040E	○			4				50	4
HLRS 2010-01-050				5				50	4
HLRS 2010-01-060				6				50	4
HLRS 2010-01-060E	○			6				50	4

※Additional model

Next Page ➡

Unit（mm）

Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
			30'	1°	1°30'	2°	3°
HLRS 2006-005-020	0.6	4	2.38	2.61	2.79	2.95	3.22
HLRS 2006-005-030		4	3.48	3.74	3.95	4.13	4.30
HLRS 2006-005-040		4	4.56	4.85	5.08	5.28	5.67
HLRS 2006-005-060		4	6.68	7.03	7.30	7.55	8.12
HLRS 2006-005-080		4	8.79	9.18	9.50	9.83	10.56
HLRS 2006-01-020		4	2.37	2.60	2.78	2.93	3.20
HLRS 2006-01-020E		4	2.37	2.60	2.78	2.93	3.20
HLRS 2006-01-030		4	3.47	3.73	3.94	4.11	4.28
HLRS 2006-01-030E		4	3.47	3.73	3.94	4.11	4.28
HLRS 2006-01-040		4	4.55	4.84	5.07	5.26	5.65
HLRS 2006-01-040E		4	4.55	4.84	5.07	5.26	5.65
HLRS 2006-01-060		4	6.68	7.03	7.30	7.54	8.10
HLRS 2006-01-080		4	8.79	9.18	9.50	9.82	10.55
HLRS 2006-02-020		4	2.34	2.56	2.74	2.90	3.18
HLRS 2006-02-030		4	3.44	3.70	3.91	4.09	4.41
HLRS 2006-02-040		4	4.53	4.82	5.05	5.23	5.61
HLRS 2006-02-060		4	6.66	7.01	7.28	7.51	8.06
HLRS 2006-02-080		4	8.79	9.17	9.48	9.81	10.53
HLRS 2007-01-040	0.7	4	4.55	4.84	5.07	5.26	5.65
HLRS 2007-01-060		4	6.68	7.03	7.30	7.54	8.10
※ HLRS 2007-02-040		4	4.53	4.82	5.05	5.23	5.61
※ HLRS 2007-02-060		4	6.66	7.01	7.28	7.51	8.06
HLRS 2008-005-060	0.8	4	4.56	4.85	5.08	5.28	5.67
HLRS 2008-005-060		4	6.68	7.03	7.30	7.55	8.12
HLRS 2008-005-080		4	8.79	9.18	9.50	9.83	10.56
HLRS 2008-01-040		4	4.55	4.84	5.07	5.26	5.65
HLRS 2008-01-060		4	6.68	7.03	7.30	7.54	8.10
HLRS 2008-01-080		4	8.79	9.18	9.50	9.82	10.55
HLRS 2008-02-040		4	4.53	4.82	5.05	5.23	5.61
HLRS 2008-02-060		4	6.66	7.01	7.28	7.51	8.06
HLRS 2008-02-080		4	8.79	9.17	9.48	9.81	10.53
HLRS 2010-005-020	1	4	2.51	2.86	2.70	3.01	3.28
HLRS 2010-005-030		4	3.59	3.82	4.01	4.18	4.51
HLRS 2010-005-040		4	4.72	4.92	5.14	5.33	5.73
HLRS 2010-005-050		4	5.72	6.01	6.25	6.47	6.95
HLRS 2010-005-060		4	6.77	7.09	7.35	7.61	8.18
HLRS 2010-005-080		4	8.87	9.24	9.55	9.88	10.62
HLRS 2010-005-100		4	10.97	11.37	11.75	12.16	13.07
HLRS 2010-005-120		4	13.05	13.50	13.96	14.44	15.52
HLRS 2010-005-160		4	17.20	17.76	18.36	18.99	20.41
HLRS 2010-005-200		4	21.33	22.02	22.76	23.55	25.31
HLRS 2010-01-020		4	2.53	2.71	2.88	3.01	3.27
HLRS 2010-01-020E		4	2.53	2.71	2.88	3.01	3.27
HLRS 2010-01-030		4	3.58	3.81	4.00	4.18	4.49
HLRS 2010-01-040		4	4.67	4.93	5.14	5.33	5.72
HLRS 2010-01-040E		4	4.67	4.93	5.14	5.33	5.72
HLRS 2010-01-050		4	5.71	6.00	6.24	6.46	6.94
HLRS 2010-01-060		4	6.78	7.10	7.36	7.60	8.17
HLRS 2010-01-060E		4	6.78	7.10	7.36	7.60	8.17

※Additional model

Next Page ➡

2 Flutes HARDMAX

Model Number	Excellent	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HLRS 2010-01-080		1	R0.1	8	1	0.95	16°	50	4
HLRS 2010-01-100				10				50	4
HLRS 2010-01-120				12				55	4
HLRS 2010-01-160				16				60	4
HLRS 2010-01-200				20				60	4
HLRS 2010-02-020			R0.2	2				50	4
HLRS 2010-02-020E	○			2				50	4
HLRS 2010-02-030				3				50	4
HLRS 2010-02-040				4				50	4
HLRS 2010-02-040E	○			4				50	4
HLRS 2010-02-050				5				50	4
HLRS 2010-02-060				6				50	4
HLRS 2010-02-060E	○			6				50	4
HLRS 2010-02-080				8				50	4
HLRS 2010-02-100				10				50	4
HLRS 2010-02-120				12				55	4
HLRS 2010-02-160				16				60	4
HLRS 2010-02-200				20				60	4
HLRS 2010-03-020			R0.3	2				50	4
HLRS 2010-03-020E	○			2				50	4
HLRS 2010-03-030				3				50	4
HLRS 2010-03-040				4				50	4
HLRS 2010-03-040E	○			4				50	4
HLRS 2010-03-050				5				50	4
HLRS 2010-03-060				6				50	4
HLRS 2010-03-060E	○			6				50	4
HLRS 2010-03-080				8				50	4
HLRS 2010-03-100				10				50	4
HLRS 2010-03-120				12				55	4
HLRS 2010-03-160				16				60	4
HLRS 2010-03-200				20				60	4
HLRS 2012-02-060		1.2	R0.2	6	1.2	1.14	16°	50	4
HLRS 2012-02-120				12				55	4
HLRS 2012-02-200				20				60	4
HLRS 2012-03-060			R0.3	6				50	4
HLRS 2012-03-120				12				55	4
HLRS 2012-03-200				20				60	4
HLRS 2015-005-040		1.5	R0.05	4				50	4
HLRS 2015-005-060				6				50	4
HLRS 2015-005-080				8				50	4
HLRS 2015-005-100				10				50	4
HLRS 2015-01-040			R0.1	4				50	4
HLRS 2015-01-060				6				50	4
HLRS 2015-01-080				8				50	4
HLRS 2015-01-100				10				50	4
HLRS 2015-01-120				12				55	4
HLRS 2015-01-160				16				55	4
HLRS 2015-01-200				20				60	4

Next Page ➡

Unit（mm）

Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
			30'	1°	1°30'	2°	3°
HLRS 2010-01-080	1	4	8.88	9.24	9.56	9.88	10.61
HLRS 2010-01-100		4	10.97	11.37	11.76	12.16	13.06
HLRS 2010-01-120		4	13.05	13.50	13.96	14.44	15.51
HLRS 2010-01-160		4	17.20	17.76	18.36	18.99	20.40
HLRS 2010-01-200		4	21.33	22.02	22.76	23.54	25.30
HLRS 2010-02-020		4	2.51	2.69	2.86	2.98	3.23
HLRS 2010-02-020E		4	2.51	2.69	2.86	2.98	3.23
HLRS 2010-02-030		4	3.58	3.80	3.99	4.16	4.47
HLRS 2010-02-040		4	4.65	4.91	5.12	5.30	5.68
HLRS 2010-02-040E		4	4.65	4.91	5.12	5.30	5.68
HLRS 2010-02-050		4	5.71	6.00	6.23	6.45	6.92
HLRS 2010-02-060		4	6.76	7.08	7.34	7.57	8.13
HLRS 2010-02-060E		4	6.76	7.08	7.34	7.57	8.13
HLRS 2010-02-080		4	8.86	9.22	9.54	9.85	10.57
HLRS 2010-02-100		4	10.95	11.35	11.74	12.13	13.02
HLRS 2010-02-120		4	13.03	13.48	13.94	14.41	15.47
HLRS 2010-02-160		4	17.18	17.74	18.34	18.96	20.36
HLRS 2010-02-200		4	21.31	22.00	22.74	23.51	25.26
HLRS 2010-03-020		4	2.49	2.67	2.84	2.95	3.19
HLRS 2010-03-020E		4	2.49	2.67	2.84	2.95	3.19
HLRS 2010-03-030		4	3.57	3.79	3.98	4.14	4.45
HLRS 2010-03-040		4	4.63	4.89	5.10	5.27	5.64
HLRS 2010-03-040E		4	4.63	4.89	5.10	5.27	5.64
HLRS 2010-03-050		4	5.70	5.99	6.22	6.43	6.90
HLRS 2010-03-060		4	6.74	7.06	7.32	7.54	8.09
HLRS 2010-03-060E		4	6.74	7.06	7.32	7.54	8.09
HLRS 2010-03-080		4	8.84	9.20	9.52	9.82	10.53
HLRS 2010-03-100		4	10.93	11.33	11.72	12.10	12.98
HLRS 2010-03-120		4	13.01	13.46	13.92	14.38	15.43
HLRS 2010-03-160		4	17.16	17.72	18.32	18.93	20.32
HLRS 2010-03-200		4	21.29	21.98	22.72	23.48	25.22
HLRS 2012-02-060	1.2	4	6.18	6.38	6.59	6.82	7.33
HLRS 2012-02-120		4	12.37	12.77	13.19	13.65	14.67
HLRS 2012-02-200		4	20.62	21.29	22.00	22.76	24.46
HLRS 2012-03-060		4	6.18	6.38	6.59	6.81	7.31
HLRS 2012-03-120		4	12.37	12.77	13.19	13.64	14.66
HLRS 2012-03-200		4	20.62	21.28	21.99	22.75	24.45
HLRS 2015-005-040	1.5	4	4.12	4.26	4.40	4.55	4.89
HLRS 2015-005-060		4	6.18	6.39	6.60	6.83	7.34
HLRS 2015-005-080		4	8.25	8.52	8.80	9.11	9.79
HLRS 2015-005-100		4	10.31	10.64	11.00	11.38	12.24
HLRS 2015-01-040		4	4.12	4.25	4.40	4.55	4.89
HLRS 2015-01-060		4	6.18	6.38	6.60	6.83	7.34
HLRS 2015-01-080		4	8.24	8.51	8.80	9.10	9.78
HLRS 2015-01-100		4	10.31	10.64	11.00	11.38	12.23
HLRS 2015-01-120		4	12.37	12.77	13.20	13.66	14.68
HLRS 2015-01-160		4	16.50	17.03	17.60	18.21	19.57
HLRS 2015-01-200		4	20.62	21.29	22.00	22.77	No Interference

Next Page ➡

2 Flutes HARDMAX

Unit（mm）

Model Number	Excellent	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HLRS 2015-02-040		1.5	R0.2	4	1.5.	1.45	16°	50	4
HLRS 2015-02-060				6				50	4
HLRS 2015-02-080				8				50	4
HLRS 2015-02-100				10				50	4
HLRS 2015-02-120				12				55	4
HLRS 2015-02-160				16				55	4
HLRS 2015-02-200				20				60	4
HLRS 2015-03-040			R0.3	4				50	4
HLRS 2015-03-060				6				50	4
HLRS 2015-03-080				8				50	4
HLRS 2015-03-100				10				50	4
HLRS 2015-03-120				12				55	4
HLRS 2015-03-160				16				55	4
HLRS 2015-03-200				20				60	4
HLRS 2015-05-040			R0.5	4				50	4
HLRS 2015-05-060				6				50	4
HLRS 2015-05-080				8				50	4
HLRS 2015-05-100				10				50	4
HLRS 2015-05-120				12				55	4
HLRS 2015-05-160				16				55	4
HLRS 2015-05-200				20				60	4
HLRS 2020-005-040		2	R0.05	4				50	4
HLRS 2020-005-060				6				50	4
HLRS 2020-005-080				8				50	4
HLRS 2020-005-100				10				50	4
HLRS 2020-01-040			R0.1	4				50	4
HLRS 2020-01-040E	○			4				50	4
HLRS 2020-01-060				6				50	4
HLRS 2020-01-060E	○			6				50	4
HLRS 2020-01-080				8				50	4
HLRS 2020-01-080E	○			8				50	4
HLRS 2020-01-100				10				50	4
HLRS 2020-01-100E	○			10				50	4
HLRS 2020-01-120				12				55	4
HLRS 2020-01-120E	○			12				55	4
HLRS 2020-01-160				16				60	4
HLRS 2020-01-200				20				60	4
HLRS 2020-01-260				26				70	4
HLRS 2020-01-300				30				70	4
HLRS 2020-02-040			R0.2	4				50	4
HLRS 2020-02-040E	○			4				50	4
HLRS 2020-02-060				6				50	4
HLRS 2020-02-060E	○			6				50	4
HLRS 2020-02-080				8				50	4
HLRS 2020-02-080E	○			8				50	4
HLRS 2020-02-100				10				50	4
HLRS 2020-02-100E	○			10				50	4

Next Page ➡

Unit（mm）

Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
			30'	1°	1°30'	2°	3°
HLRS 2015-02-040	1.5	4	4.12	4.25	4.39	4.54	4.88
HLRS 2015-02-060		4	6.18	6.38	6.59	6.82	7.33
HLRS 2015-02-080		4	8.24	8.51	8.79	9.10	9.77
HLRS 2015-02-100		4	10.31	10.64	10.99	11.37	12.22
HLRS 2015-02-120		4	12.37	12.77	13.19	13.65	14.67
HLRS 2015-02-160		4	16.49	17.03	17.60	18.21	19.56
HLRS 2015-02-200		4	20.62	21.29	22.00	22.76	No Interference
HLRS 2015-03-040		4	4.12	4.25	4.39	4.54	4.87
HLRS 2015-03-060		4	6.18	6.38	6.59	6.81	7.31
HLRS 2015-03-080		4	8.24	8.51	8.79	9.09	9.76
HLRS 2015-03-100		4	10.30	10.64	10.99	11.37	12.21
HLRS 2015-03-120		4	12.37	12.77	13.19	13.64	14.66
HLRS 2015-03-160		4	16.49	17.02	17.59	18.20	19.55
HLRS 2015-03-200		4	20.62	21.28	21.99	22.75	No Interference
HLRS 2015-05-040		4	4.11	4.24	4.38	4.52	4.85
HLRS 2015-05-060		4	6.18	6.37	6.58	6.80	7.29
HLRS 2015-05-080		4	8.24	8.50	8.78	9.08	9.74
HLRS 2015-05-100		4	10.30	10.63	10.98	11.35	12.19
HLRS 2015-05-120		4	12.36	12.76	13.18	13.63	14.64
HLRS 2015-05-160		4	16.49	17.02	17.58	18.19	19.53
HLRS 2015-05-200		4	20.62	21.28	21.98	22.74	24.42
HLRS 2020-005-040	2	4	4.16	4.29	4.44	4.59	4.94
HLRS 2020-005-060		4	6.22	6.42	6.64	6.87	7.38
HLRS 2020-005-080		4	8.28	8.55	8.84	9.15	9.83
HLRS 2020-005-100		4	10.35	10.68	11.04	11.42	12.28
HLRS 2020-01-040		4	4.16	4.29	4.43	4.59	4.93
HLRS 2020-01-040E		4	4.16	4.29	4.43	4.59	4.93
HLRS 2020-01-060		4	6.22	6.42	6.64	6.87	7.38
HLRS 2020-01-060E		4	6.22	6.42	6.64	6.87	7.38
HLRS 2020-01-080		4	8.28	8.55	8.84	9.14	9.83
HLRS 2020-01-080E		4	8.28	8.55	8.84	9.14	9.83
HLRS 2020-01-100		4	10.34	10.68	11.04	11.42	12.27
HLRS 2020-01-100E		4	10.34	10.68	11.04	11.42	12.27
HLRS 2020-01-120		4	12.41	12.81	13.24	13.70	14.72
HLRS 2020-01-120E		4	12.41	12.81	13.24	13.70	14.72
HLRS 2020-01-160		4	16.53	17.07	17.64	18.25	No Interference
HLRS 2020-01-200		4	20.66	21.33	22.04	22.81	No Interference
HLRS 2020-01-260		4	26.85	27.72	28.65	No Interference	No Interference
HLRS 2020-01-300		4	30.97	31.98	33.05	No Interference	No Interference
HLRS 2020-02-040		4	4.15	4.29	4.43	4.58	4.92
HLRS 2020-02-040E		4	4.15	4.29	4.43	4.58	4.92
HLRS 2020-02-060		4	6.22	6.42	6.63	6.86	7.37
HLRS 2020-02-060E		4	6.22	6.42	6.63	6.86	7.37
HLRS 2020-02-080		4	8.28	8.55	8.83	9.14	9.82
HLRS 2020-02-080E		4	8.28	8.55	8.83	9.14	9.82
HLRS 2020-02-100		4	10.34	10.68	11.03	11.41	12.26
HLRS 2020-02-100E		4	10.34	10.68	11.03	11.41	12.26

Next Page ➡

2 Flutes HARDMAX

Model Number	Excellent	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HLRS 2020-02-120		2	R0.3	12	2	1.92	16°	55	4
HLRS 2020-02-120E	○			12				55	4
HLRS 2020-02-160				16				60	4
HLRS 2020-02-200				20				60	4
HLRS 2020-02-260				26				70	4
HLRS 2020-02-300				30				70	4
HLRS 2020-03-040				4				50	4
HLRS 2020-03-040E	○			4				50	4
HLRS 2020-03-060				6				50	4
HLRS 2020-03-060E	○			6				50	4
HLRS 2020-03-080				8				50	4
HLRS 2020-03-080E	○			8				50	4
HLRS 2020-03-100				10				50	4
HLRS 2020-03-100E	○			10				50	4
HLRS 2020-03-120				12				55	4
HLRS 2020-03-120E	○			12				55	4
HLRS 2020-03-160				16				60	4
HLRS 2020-03-200				20				60	4
HLRS 2020-03-260				26				70	4
HLRS 2020-03-300				30				70	4
HLRS 2020-05-040			R0.5	4				50	4
HLRS 2020-05-040E	○			4				50	4
HLRS 2020-05-060				6				50	4
HLRS 2020-05-060E	○			6				50	4
HLRS 2020-05-080				8				50	4
HLRS 2020-05-080E	○			8				50	4
HLRS 2020-05-100				10				50	4
HLRS 2020-05-100E	○			10				50	4
HLRS 2020-05-120				12				55	4
HLRS 2020-05-120E	○			12				55	4
HLRS 2020-05-160				16				60	4
HLRS 2020-05-200				20				60	4
HLRS 2020-05-260				26				70	4
HLRS 2020-05-300				30				70	4
HLRS 2025-01-100		2.5	R0.1	10	2.5	2.42	16°	50	4
HLRS 2025-01-200				20				60	4
HLRS 2025-01-300				30				70	4
HLRS 2025-02-100			R0.2	10				50	4
HLRS 2025-02-200				20				60	4
HLRS 2025-02-300				30				70	4
HLRS 2025-03-100			R0.3	10				50	4
HLRS 2025-03-200				20				60	4
HLRS 2025-03-300				30				70	4
HLRS 2025-05-100			R0.5	10				50	4
HLRS 2025-05-200				20				60	4
HLRS 2025-05-300				30				70	4

Next Page ➡

Unit（mm）

Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
			30'	1°	1°30'	2°	3°
HLRS 2020-02-120	2	4	12.40	12.81	13.23	13.69	14.71
HLRS 2020-02-120E		4	12.40	12.81	13.23	13.69	14.71
HLRS 2020-02-160		4	16.53	17.06	17.64	18.25	No Interference
HLRS 2020-02-200		4	20.66	21.32	22.04	22.80	No Interference
HLRS 2020-02-260		4	26.84	27.71	28.64	No Interference	No Interference
HLRS 2020-02-300		4	30.97	31.97	33.04	No Interference	No Interference
HLRS 2020-03-040		4	4.15	4.28	4.42	4.57	4.91
HLRS 2020-03-040E		4	4.15	4.28	4.42	4.57	4.91
HLRS 2020-03-060		4	6.21	6.41	6.63	6.85	7.36
HLRS 2020-03-060E		4	6.21	6.41	6.63	6.85	7.36
HLRS 2020-03-080		4	8.28	8.54	8.83	9.13	9.80
HLRS 2020-03-080E		4	8.28	8.54	8.83	9.13	9.80
HLRS 2020-03-100		4	10.34	10.67	11.03	11.41	12.25
HLRS 2020-03-100E		4	10.34	10.67	11.03	11.41	12.25
HLRS 2020-03-120		4	12.40	12.80	13.23	13.68	14.70
HLRS 2020-03-120E		4	12.40	12.80	13.23	13.68	14.70
HLRS 2020-03-160		4	16.53	17.06	17.63	18.24	19.59
HLRS 2020-03-200		4	20.65	21.32	22.03	22.79	No Interference
HLRS 2020-03-260		4	26.84	27.71	28.64	No Interference	No Interference
HLRS 2020-03-300		4	30.97	31.97	33.04	No Interference	No Interference
HLRS 2020-05-040		4	4.15	4.28	4.41	4.56	4.89
HLRS 2020-05-040E		4	4.15	4.28	4.41	4.56	4.89
HLRS 2020-05-060		4	6.21	6.41	6.62	6.84	7.34
HLRS 2020-05-060E		4	6.21	6.41	6.62	6.84	7.34
HLRS 2020-05-080		4	8.27	8.54	8.82	9.12	9.78
HLRS 2020-05-080E		4	8.27	8.54	8.82	9.12	9.78
HLRS 2020-05-100		4	10.34	10.67	11.02	11.39	12.23
HLRS 2020-05-100E		4	10.34	10.67	11.02	11.39	12.23
HLRS 2020-05-120		4	12.40	12.80	13.22	13.67	14.68
HLRS 2020-05-120E		4	12.40	12.80	13.22	13.67	14.68
HLRS 2020-05-160		4	16.53	17.06	17.62	18.23	19.57
HLRS 2020-05-200		4	20.65	21.31	22.02	22.78	No Interference
HLRS 2020-05-260		4	26.84	27.70	28.63	No Interference	No Interference
HLRS 2020-05-300		4	30.97	31.96	33.03	No Interference	No Interference
HLRS 2025-01-100	2.5	4	10.34	10.68	11.04	11.42	12.27
HLRS 2025-01-200		4	20.66	21.33	22.04	No Interference	No Interference
HLRS 2025-01-300		4	30.97	31.98	No Interference	No Interference	No Interference
HLRS 2025-02-100		4	10.34	10.68	11.03	11.41	12.26
HLRS 2025-02-200		4	20.66	21.32	22.04	No Interference	No Interference
HLRS 2025-02-300		4	30.97	31.97	No Interference	No Interference	No Interference
HLRS 2025-03-100		4	10.34	10.67	11.03	11.41	12.25
HLRS 2025-03-200		4	20.65	21.32	22.03	No Interference	No Interference
HLRS 2025-03-300		4	30.97	31.97	No Interference	No Interference	No Interference
HLRS 2025-05-100		4	10.34	10.67	11.02	11.39	12.23
HLRS 2025-05-200		4	20.65	21.31	22.02	No Interference	No Interference
HLRS 2025-05-300		4	30.97	31.96	No Interference	No Interference	No Interference

Next Page ➡

2 Flutes HARDMAX

Model Number	Excellent	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HLRS 2030-01-060		3	R0.1	6	3	2.92	16°	55	6
HLRS 2030-01-060E	○			6				55	6
HLRS 2030-01-120				12				55	6
HLRS 2030-01-160				16				60	6
HLRS 2030-01-160E	○			16				60	6
HLRS 2030-01-180				18				60	6
HLRS 2030-01-200				20				60	6
HLRS 2030-01-260				26				70	6
HLRS 2030-01-300				30				70	6
HLRS 2030-01-360				36				80	6
HLRS 2030-02-060			R0.2	6				55	6
HLRS 2030-02-060E	○			6				55	6
HLRS 2030-02-120				12				55	6
HLRS 2030-02-160				16				60	6
HLRS 2030-02-160E	○			16				60	6
HLRS 2030-02-180				18				60	6
HLRS 2030-02-200				20				60	6
HLRS 2030-02-260				26				70	6
HLRS 2030-02-300				30				70	6
HLRS 2030-02-360				36				80	6
HLRS 2030-03-060			R0.3	6				55	6
HLRS 2030-03-060E	○			6				55	6
HLRS 2030-03-120				12				55	6
HLRS 2030-03-160				16				60	6
HLRS 2030-03-160E	○			16				60	6
HLRS 2030-03-180				18				60	6
HLRS 2030-03-200				20				60	6
HLRS 2030-03-260				26				70	6
HLRS 2030-03-300				30				70	6
HLRS 2030-03-360				36				80	6
HLRS 2030-05-060			R0.5	6				55	6
HLRS 2030-05-060E	○			6				55	6
HLRS 2030-05-120				12				55	6
HLRS 2030-05-160				16				60	6
HLRS 2030-05-160E	○			16				60	6
HLRS 2030-05-180				18				60	6
HLRS 2030-05-200				20				60	6
HLRS 2030-05-260				26				70	6
HLRS 2030-05-300				30				70	6
HLRS 2030-05-360				36				80	6
HLRS 2030-10-060			R1	6				55	6
HLRS 2030-10-060E	○			6				55	6
HLRS 2030-10-120				12				55	6
HLRS 2030-10-160				16				60	6
HLRS 2030-10-160E	○			16				60	6
HLRS 2030-10-180				18				60	6
HLRS 2030-10-200				20				60	6
HLRS 2030-10-260				26				70	6
HLRS 2030-10-300				30				70	6
HLRS 2030-10-360				36				80	6

Next Page ➡

Unit（mm）

Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
			30'	1°	1°30'	2°	3°
HLRS 2030-01-060	3	6	6.21	6.42	6.63	6.86	7.37
HLRS 2030-01-060E		6	6.21	6.42	6.63	6.86	7.37
HLRS 2030-01-120		6	12.40	12.81	13.23	13.69	14.72
HLRS 2030-01-160		6	16.53	17.06	17.64	18.25	19.61
HLRS 2030-01-160E		6	16.53	17.06	17.64	18.25	19.61
HLRS 2030-01-180		6	18.59	19.19	19.84	20.53	22.06
HLRS 2030-01-200		6	20.65	21.32	22.04	22.80	24.51
HLRS 2030-01-260		6	26.84	27.71	28.64	29.64	No Interference
HLRS 2030-01-300		6	30.97	31.97	33.04	34.19	No Interference
HLRS 2030-01-360		6	37.16	38.36	39.65	41.02	No Interference
HLRS 2030-02-060		6	6.21	6.41	6.63	6.85	7.36
HLRS 2030-02-060E		6	6.21	6.41	6.63	6.85	7.36
HLRS 2030-02-120		6	12.40	12.80	13.23	13.69	14.71
HLRS 2030-02-160		6	16.53	17.06	17.63	18.24	19.60
HLRS 2030-02-160E		6	16.53	17.06	17.63	18.24	19.60
HLRS 2030-02-180		6	18.59	19.19	19.83	20.52	22.05
HLRS 2030-02-200		6	20.65	21.32	22.03	22.80	24.49
HLRS 2030-02-260		6	26.84	27.71	28.64	29.63	No Interference
HLRS 2030-02-300		6	30.97	31.97	33.04	34.18	No Interference
HLRS 2030-02-360		6	37.15	38.36	39.64	41.02	No Interference
HLRS 2030-03-060		6	6.21	6.41	6.62	6.85	7.35
HLRS 2030-03-060E		6	6.21	6.41	6.62	6.85	7.35
HLRS 2030-03-120		6	12.40	12.80	13.22	13.68	14.70
HLRS 2030-03-160		6	16.53	17.06	17.63	18.23	19.59
HLRS 2030-03-160E		6	16.53	17.06	17.63	18.23	19.59
HLRS 2030-03-180		6	18.59	19.19	19.83	20.51	22.04
HLRS 2030-03-200		6	20.65	21.32	22.03	22.79	24.48
HLRS 2030-03-260		6	26.84	27.71	28.63	29.62	No Interference
HLRS 2030-03-300		6	30.96	31.97	33.03	34.18	No Interference
HLRS 2030-03-360		6	37.15	38.35	39.64	41.01	No Interference
HLRS 2030-05-060		6	6.21	6.40	6.61	6.83	7.33
HLRS 2030-05-060E		6	6.21	6.40	6.61	6.83	7.33
HLRS 2030-05-120		6	12.40	12.79	13.21	13.67	14.67
HLRS 2030-05-160		6	16.52	17.05	17.62	18.22	19.57
HLRS 2030-05-160E		6	16.52	17.05	17.62	18.22	19.57
HLRS 2030-05-180		6	18.58	19.18	19.82	20.50	22.02
HLRS 2030-05-200		6	20.65	21.31	22.02	22.78	24.46
HLRS 2030-05-260		6	26.84	27.70	28.62	29.61	No Interference
HLRS 2030-05-300		6	30.96	31.96	33.02	34.16	No Interference
HLRS 2030-05-360		6	37.15	38.35	39.63	41.00	No Interference
HLRS 2030-10-060		6	6.20	6.39	6.59	6.80	7.28
HLRS 2030-10-060E		6	6.20	6.39	6.59	6.80	7.28
HLRS 2030-10-120		6	12.39	12.78	13.19	13.63	14.62
HLRS 2030-10-160		6	16.51	17.04	17.59	18.19	19.52
HLRS 2030-10-160E		6	16.51	17.04	17.59	18.19	19.52
HLRS 2030-10-180		6	18.58	19.17	19.79	20.47	21.96
HLRS 2030-10-200		6	20.64	21.29	21.99	22.74	24.41
HLRS 2030-10-260		6	26.83	27.68	28.60	29.57	No Interference
HLRS 2030-10-300		6	30.95	31.94	33.00	34.13	No Interference
HLRS 2030-10-360		6	37.14	38.33	39.60	40.96	No Interference

Next Page ➡

2 Flutes HARDMAX

Model Number	Excellent	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HLRS 2040-01-080				8				65	6
HLRS 2040-01-080E	○			8				65	6
HLRS 2040-01-120				12				65	6
HLRS 2040-01-160				16				65	6
HLRS 2040-01-200			R0.1	20				65	6
HLRS 2040-01-200E	○			20				65	6
HLRS 2040-01-240				24				70	6
HLRS 2040-01-320				32				80	6
HLRS 2040-01-480				48				100	6
HLRS 2040-02-080				8				65	6
HLRS 2040-02-080E	○			8				65	6
HLRS 2040-02-120				12				65	6
HLRS 2040-02-160				16				65	6
HLRS 2040-02-200			R0.2	20				65	6
HLRS 2040-02-200E	○			20				65	6
HLRS 2040-02-240				24				70	6
HLRS 2040-02-320				32				80	6
HLRS 2040-02-480				48				100	6
HLRS 2040-03-080				8				65	6
HLRS 2040-03-080E	○			8				65	6
HLRS 2040-03-120				12				65	6
HLRS 2040-03-160				16				65	6
HLRS 2040-03-200		4	R0.3	20	4	3.82	16°	65	6
HLRS 2040-03-200E	○			20				65	6
HLRS 2040-03-240				24				70	6
HLRS 2040-03-320				32				80	6
HLRS 2040-03-480				48				100	6
HLRS 2040-05-080				8				65	6
HLRS 2040-05-080E	○			8				65	6
HLRS 2040-05-120				12				65	6
HLRS 2040-05-160				16				65	6
HLRS 2040-05-200			R0.5	20				65	6
HLRS 2040-05-200E	○			20				65	6
HLRS 2040-05-240				24				70	6
HLRS 2040-05-320				32				80	6
HLRS 2040-05-480				48				100	6
HLRS 2040-10-080				8				65	6
HLRS 2040-10-080E	○			8				65	6
HLRS 2040-10-120				12				65	6
HLRS 2040-10-160				16				65	6
HLRS 2040-10-200			R1	20				65	6
HLRS 2040-10-200E	○			20				65	6
HLRS 2040-10-240				24				70	6
HLRS 2040-10-320				32				80	6
HLRS 2040-10-480				48				100	6

Next Page ➡

Unit（mm）

Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
			30'	1°	1°30'	2°	3°
HLRS 2040-01-080	4	6	8.45	8.73	9.02	9.33	10.03
HLRS 2040-01-080E		6	8.45	8.73	9.02	9.33	10.03
HLRS 2040-01-120		6	12.58	12.99	13.42	13.89	14.92
HLRS 2040-01-160		6	16.70	17.25	17.82	18.44	No Interference
HLRS 2040-01-200		6	20.83	21.50	22.23	23.00	No Interference
HLRS 2040-01-200E		6	20.83	21.50	22.23	23.00	No Interference
HLRS 2040-01-240		6	24.95	25.76	26.63	27.55	No Interference
HLRS 2040-01-320		6	33.21	34.28	35.43	No Interference	No Interference
HLRS 2040-01-480		6	49.71	51.32	No Interference	No Interference	No Interference
HLRS 2040-02-080		6	8.45	8.72	9.01	9.33	10.02
HLRS 2040-02-080E		6	8.45	8.72	9.01	9.33	10.02
HLRS 2040-02-120		6	12.58	12.98	13.42	13.88	14.91
HLRS 2040-02-160		6	16.70	17.24	17.82	18.44	No Interference
HLRS 2040-02-200		6	20.83	21.50	22.22	22.99	No Interference
HLRS 2040-02-200E		6	20.83	21.50	22.22	22.99	No Interference
HLRS 2040-02-240		6	24.95	25.76	26.62	27.54	No Interference
HLRS 2040-02-320		6	33.20	34.28	35.43	No Interference	No Interference
HLRS 2040-02-480		6	49.71	51.32	No Interference	No Interference	No Interference
HLRS 2040-03-080		6	8.45	8.72	9.01	9.32	10.01
HLRS 2040-03-080E		6	8.45	8.72	9.01	9.32	10.01
HLRS 2040-03-120		6	12.58	12.98	13.41	13.87	14.69
HLRS 2040-03-160		6	16.70	17.24	17.81	18.43	No Interference
HLRS 2040-03-200		6	20.83	21.50	22.22	22.98	No Interference
HLRS 2040-03-200E		6	20.83	21.50	22.22	22.98	No Interference
HLRS 2040-03-240		6	24.95	25.76	26.62	27.54	No Interference
HLRS 2040-03-320		6	33.20	34.28	35.42	No Interference	No Interference
HLRS 2040-03-480		6	49.71	51.31	No Interference	No Interference	No Interference
HLRS 2040-05-080		6	8.45	8.71	9.00	9.31	9.99
HLRS 2040-05-080E		6	8.45	8.71	9.00	9.31	9.99
HLRS 2040-05-120		6	12.57	12.97	13.40	13.86	14.88
HLRS 2040-05-160		6	16.70	17.23	17.80	18.42	No Interference
HLRS 2040-05-200		6	20.82	21.49	22.21	22.97	No Interference
HLRS 2040-05-200E		6	20.82	21.49	22.21	22.97	No Interference
HLRS 2040-05-240		6	24.95	25.75	26.61	27.52	No Interference
HLRS 2040-05-320		6	33.20	34.27	35.41	No Interference	No Interference
HLRS 2040-05-480		6	49.70	51.31	No Interference	No Interference	No Interference
HLRS 2040-10-080		6	8.44	8.70	8.98	9.27	9.93
HLRS 2040-10-080E		6	8.44	8.70	8.98	9.27	9.93
HLRS 2040-10-120		6	12.56	12.96	13.38	13.83	14.83
HLRS 2040-10-160		6	16.69	17.22	17.78	18.38	19.72
HLRS 2040-10-200		6	20.82	21.48	22.18	22.94	No Interference
HLRS 2040-10-200E		6	20.82	21.48	22.18	22.94	No Interference
HLRS 2040-10-240		6	24.94	25.74	26.58	27.49	No Interference
HLRS 2040-10-320		6	33.19	34.25	35.39	No Interference	No Interference
HLRS 2040-10-480		6	49.69	51.29	No Interference	No Interference	No Interference

Next Page ➡

2 Flutes HARDMAX

Model Number	Excellent	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HLRS 2050-02-200		5	R0.2	20	5	4.82	16°	70	6
HLRS 2050-02-400				40				90	6
HLRS 2050-03-200			R0.3	20				70	6
HLRS 2050-03-400				40				90	6
HLRS 2050-05-200			R0.5	20				70	6
HLRS 2050-05-400				40				90	6
HLRS 2050-10-200			R1	20				70	6
HLRS 2050-10-400				40				90	6
HLRS 2060-01-120		6	R0.1	12	6	5.82	—	65	6
HLRS 2060-01-120E	○			12				65	6
HLRS 2060-01-200				20				70	6
HLRS 2060-01-300				30				100	6
HLRS 2060-01-300E	○			30				100	6
HLRS 2060-01-600				60				120	6
HLRS 2060-02-120			R0.2	12				65	6
HLRS 2060-02-120E	○			12				65	6
HLRS 2060-02-200				20				70	6
HLRS 2060-02-300				30				100	6
HLRS 2060-02-300E	○			30				100	6
HLRS 2060-02-600				60				120	6
HLRS 2060-03-120			R0.3	12				65	6
HLRS 2060-03-120E	○			12				65	6
HLRS 2060-03-200				20				70	6
HLRS 2060-03-300				30				100	6
HLRS 2060-03-300E	○			30				100	6
HLRS 2060-03-600				60				120	6
HLRS 2060-05-120			R0.5	12				65	6
HLRS 2060-05-120E	○			12				65	6
HLRS 2060-05-200				20				70	6
HLRS 2060-05-300				30				100	6
HLRS 2060-05-300E	○			30				100	6
HLRS 2060-05-600				60				120	6
HLRS 2060-10-120			R1	12				65	6
HLRS 2060-10-120E	○			12				65	6
HLRS 2060-10-200				20				70	6
HLRS 2060-10-300				30				100	6
HLRS 2060-10-300E	○			30				100	6
HLRS 2060-10-600				60				120	6

Next Page ➡

Unit（mm）

Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
			30'	1°	1°30'	2°	3°
HLRS 2050-02-200	5	6	20.83	21.50	No Interference	No Interference	No Interference
HLRS 2050-02-400		6	41.46	No Interference	No Interference	No Interference	No Interference
HLRS 2050-03-200		6	20.83	21.50	No Interference	No Interference	No Interference
HLRS 2050-03-400		6	41.45	No Interference	No Interference	No Interference	No Interference
HLRS 2050-05-200		6	20.82	21.49	No Interference	No Interference	No Interference
HLRS 2050-05-400		6	41.45	No Interference	No Interference	No Interference	No Interference
HLRS 2050-10-200		6	20.82	21.48	No Interference	No Interference	No Interference
HLRS 2050-10-400		6	41.44	No Interference	No Interference	No Interference	No Interference
HLRS 2060-01-120	6	6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-01-120E		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-01-200		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-01-300		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-01-300E		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-01-600		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-02-120		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-02-120E		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-02-200		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-02-300		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-02-300E		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-02-600		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-03-120		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-03-120E		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-03-200		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-03-300		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-03-300E		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-03-600		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-05-120		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-05-120E		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-05-200		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-05-300		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-05-300E		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-05-600		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-10-120		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-10-120E		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-10-200		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-10-300		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-10-300E		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 2060-10-600		6	No Interference	No Interference	No Interference	No Interference	No Interference

Milling Conditions for HLRS (2 Flutes)

WORK MATERIAL			Copper OFC/TPC				PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC)				HARDENED STEELS SKD / SKT (45~55HRC)				HARDENED STEELS SKD / SKH (55~65HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2002	0.2	0.5	55,000	230	0.027	0.020	55,000	230	0.006	0.020	44,800	236	0.005	0.020	19,000	30	0.002	0.015
		1	55,000	200	0.027	0.020	55,000	200	0.006	0.020	35,000	150	0.004	0.020	15,000	25	0.0015	0.015
		1.5	55,000	180	0.017	0.010	55,000	180	0.005	0.010	27,000	100	0.003	0.010	12,000	20	0.001	0.007
		2	55,000	170	0.007	0.005	55,000	170	0.003	0.005	20,000	60	0.002	0.005	10,500	15	0.001	0.003
2003	0.3	1	60,000	500	0.030	0.020	60,000	500	0.007	0.020	35,000	350	0.005	0.020	22,000	35	0.004	0.015
		1.5	60,000	470	0.030	0.020	60,000	470	0.007	0.020	35,000	310	0.005	0.018	22,000	33	0.004	0.015
		2	60,000	400	0.030	0.020	60,000	400	0.007	0.020	33,200	250	0.005	0.015	20,000	32	0.004	0.015
		2.5	57,000	330	0.030	0.017	57,000	330	0.007	0.017	30,000	180	0.003	0.012	18,000	30	0.002	0.012
		3	52,000	220	0.030	0.015	52,000	220	0.006	0.015	25,000	80	0.003	0.010	15,000	20	0.002	0.010
2004	0.4	1	50,900	610	0.048	0.063	50,900	510	0.013	0.072	40,700	370	0.011	0.072	24,200	40	0.004	0.072
		1.5	45,200	580	0.045	0.063	45,200	480	0.012	0.054	36,200	360	0.010	0.054	21,500	38	0.004	0.054
		2	40,400	540	0.042	0.054	40,400	450	0.011	0.045	32,300	330	0.009	0.045	19,200	35	0.004	0.045
		3	33,900	460	0.027	0.054	33,900	390	0.008	0.027	27,100	280	0.007	0.027	16,100	30	0.003	0.027
		4	30,000	220	0.010	0.045	30,000	340	0.006	0.014	24,000	250	0.005	0.014	14,300	27	0.002	0.014
2005	0.5	1	49,200	1,370	0.081	0.117	49,200	1,140	0.034	0.122	40,000	860	0.030	0.122	24,800	94	0.013	0.122
		2	39,900	1,000	0.075	0.108	39,900	830	0.029	0.117	32,500	630	0.026	0.117	20,100	68	0.011	0.117
		3	31,900	770	0.057	0.090	31,900	640	0.023	0.113	26,000	480	0.020	0.113	16,100	52	0.008	0.113
		4	29,100	660	0.039	0.072	29,100	550	0.016	0.108	23,700	410	0.014	0.108	14,600	45	0.006	0.108
		5	26,400	570	0.027	0.045	26,400	470	0.011	0.099	21,500	360	0.010	0.099	13,300	39	0.004	0.099
		6	24,200	480	0.021	0.018	24,200	400	0.007	0.090	19,700	300	0.006	0.090	12,200	33	0.003	0.090
2006	0.6	2	28,600	610	0.114	0.162	28,600	510	0.010	0.219	23,700	390	0.010	0.219	15,200	43	0.004	0.219
		3	23,800	480	0.090	0.135	23,800	400	0.008	0.108	19,700	300	0.007	0.108	12,600	33	0.003	0.108
		4	20,400	400	0.063	0.108	20,400	330	0.005	0.104	16,800	250	0.005	0.104	10,800	28	0.002	0.1035
		6	16,800	300	0.036	0.045	16,800	250	0.003	0.099	13,900	190	0.003	0.099	8,900	21	0.001	0.099
		8	14,600	240	0.021	0.027	14,600	200	0.002	0.072	12,100	150	0.002	0.072	7,700	16	0.001	0.072
2007	0.7	4	18,400	480	0.087	0.162	18,400	400	0.008	0.117	15,500	310	0.008	0.117	10,200	35	0.004	0.117
		6	15,400	360	0.051	0.108	15,400	300	0.005	0.108	13,000	230	0.005	0.108	8,600	26	0.002	0.108
2008	0.8	4	17,500	540	0.132	0.198	17,500	450	0.014	0.117	15,000	360	0.015	0.117	10,200	41	0.007	0.117
		6	14,600	410	0.075	0.144	14,600	340	0.008	0.108	12,500	270	0.008	0.108	8,500	30	0.004	0.108
		8	12,800	310	0.030	0.100	12,800	270	0.005	0.090	11,000	185	0.004	0.090	7,600	20	0.002	0.090
2010	1	2	17,600	1,100	0.210	0.450	17,600	920	0.035	0.270	15,300	750	0.040	0.270	10,900	89	0.020	0.270
		3	15,500	1,050	0.205	0.425	15,500	870	0.031	0.270	13,200	720	0.037	0.270	9,400	86	0.018	0.270
		4	13,800	980	0.201	0.405	13,800	820	0.030	0.270	12,000	670	0.035	0.270	8,500	80	0.017	0.270
		5	12,500	900	0.160	0.400	12,500	720	0.025	0.240	11,000	600	0.030	0.240	7,800	72	0.015	0.240
		6	11,300	790	0.117	0.387	11,300	650	0.021	0.216	9,800	540	0.024	0.216	7,000	64	0.012	0.216
		8	9,800	590	0.072	0.360	9,800	490	0.016	0.189	8,500	400	0.018	0.189	6,100	48	0.009	0.189
		10	8,800	390	0.048	0.315	8,800	320	0.011	0.126	7,600	270	0.013	0.126	5,400	32	0.006	0.126
		12	8,100	260	0.033	0.270	8,100	210	0.008	0.072	7,000	180	0.009	0.072	5,000	21	0.004	0.072
		16	7,000	230	0.018	0.225	7,000	190	0.004	0.027	6,100	160	0.005	0.027	4,300	19	0.002	0.027
		20	6,300	160	0.015	0.180	6,300	130	0.003	0.018	5,500	110	0.003	0.018	3,900	13	0.001	0.018

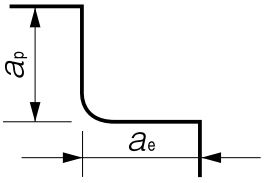
Milling Conditions for HLRS (2 Flutes)

WORK MATERIAL			Copper OFC/TPC				PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC)				HARDENED STEELS SKD / SKT (45~55HRC)				HARDENED STEELS SKD / SKH (55~65HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2012	**1.2**	6	9,400	700	0.186	0.468	9,400	580	0.018	0.090	8,400	490	0.022	0.090	6,200	60	0.011	0.090
		12	6,800	440	0.054	0.405	6,800	370	0.007	0.072	6,100	310	0.008	0.072	4,500	38	0.004	0.072
		20	5,400	250	0.021	0.240	5,400	210	0.003	0.018	4,800	180	0.003	0.018	3,500	22	0.002	0.018
2015	**1.5**	4	13,200	1,310	0.300	0.675	13,200	1,090	0.045	0.450	12,000	950	0.060	0.450	9,200	124	0.033	0.450
		6	10,600	1,240	0.282	0.630	10,600	1,030	0.041	0.405	9,700	900	0.055	0.405	7,400	117	0.030	0.405
		8	9,300	1,050	0.204	0.612	9,300	870	0.034	0.315	8,500	760	0.045	0.315	6,500	99	0.025	0.315
		10	8,500	900	0.150	0.567	8,500	750	0.032	0.288	7,800	650	0.042	0.288	6,000	85	0.023	0.288
		12	7,800	800	0.114	0.540	7,800	670	0.029	0.270	7,100	580	0.038	0.270	5,400	76	0.021	0.270
		16	6,800	620	0.066	0.450	6,800	510	0.015	0.180	6,200	450	0.020	0.180	4,700	58	0.011	0.180
		20	6,000	490	0.042	0.360	6,000	410	0.005	0.108	5,500	360	0.006	0.108	4,200	46	0.003	0.108
2020	**2**	4	15,300	1,500	0.330	0.900	15,300	1,250	0.046	0.900	14,300	1,130	0.065	0.900	11,500	162	0.039	0.900
		6	12,800	1,220	0.321	0.855	12,800	1,020	0.043	0.810	12,000	930	0.060	0.810	9,700	133	0.036	0.810
		8	11,200	1,120	0.267	0.810	11,200	930	0.039	0.720	10,400	850	0.055	0.720	8,400	121	0.033	0.720
		10	10,000	1,050	0.225	0.765	10,000	870	0.033	0.585	9,300	790	0.047	0.585	7,600	113	0.028	0.585
		12	9,100	980	0.186	0.720	9,100	820	0.031	0.450	8,500	740	0.044	0.450	6,900	107	0.026	0.450
		16	7,800	830	0.132	0.702	7,800	690	0.028	0.315	7,300	630	0.039	0.315	5,900	90	0.023	0.315
		20	7,000	770	0.093	0.666	7,000	640	0.017	0.198	6,600	580	0.024	0.198	5,300	84	0.014	0.198
		26	6,200	700	0.060	0.540	6,200	580	0.006	0.144	5,800	530	0.008	0.144	4,600	75	0.005	0.144
		30	6,000	670	0.050	0.450	6,000	550	0.005	0.135	5,500	500	0.005	0.135	4,400	70	0.002	0.135
2025	**2.5**	10	10,500	1,220	0.339	0.855	10,500	1,020	0.052	0.540	10,000	960	0.075	0.540	8,400	154	0.048	0.540
		20	7,800	720	0.165	0.756	7,800	600	0.024	0.225	7,500	560	0.035	0.225	6,300	91	0.022	0.225
		30	6,300	540	0.069	0.630	6,300	450	0.011	0.180	6,000	420	0.016	0.180	5,000	67	0.010	0.180
2030	**3**	6	14,000	2,700	0.500	0.900	14,000	1,510	0.150	0.720	13,300	1,140	0.150	0.720	12,000	270	0.100	0.720
		12	10,500	1,600	0.390	0.850	10,500	1,150	0.105	0.670	10,000	890	0.105	0.670	9,000	200	0.075	0.670
		16	9,200	1,160	0.321	0.810	9,200	960	0.081	0.630	8,800	730	0.081	0.630	7,900	173	0.054	0.630
		18	8,800	1,100	0.290	0.790	8,800	900	0.078	0.600	8,300	700	0.078	0.600	7,500	160	0.048	0.600
		20	8,400	1,050	0.260	0.780	8,400	880	0.073	0.580	7,900	680	0.073	0.580	7,100	150	0.044	0.580
		26	7,500	980	0.180	0.720	7,500	820	0.065	0.495	7,100	620	0.065	0.495	6,400	146	0.043	0.495
		30	7,000	870	0.140	0.690	7,000	720	0.050	0.380	6,500	560	0.050	0.380	6,000	118	0.029	0.360
		36	6,400	710	0.090	0.630	6,400	590	0.022	0.180	6,100	440	0.022	0.180	5,500	105	0.014	0.180
2040	**4**	8	10,200	1,340	0.420	1.620	10,200	1,110	0.095	1.350	8,500	970	0.140	1.350	7,300	223	0.101	1.350
		12	8,900	1,300	0.410	1.560	8,900	1,080	0.083	1.150	7,600	950	0.120	1.150	6,400	215	0.085	1.150
		16	7,900	1,250	0.400	1.500	7,900	1,030	0.065	1.000	6,600	910	0.100	1.000	5,600	205	0.065	1.000
		20	6,900	1,190	0.384	1.440	6,900	990	0.054	0.900	5,800	860	0.080	0.900	4,900	198	0.058	0.900
		24	6,200	1,100	0.310	1.380	6,200	900	0.043	0.800	5,200	770	0.065	0.800	4,500	175	0.043	0.800
		32	5,500	860	0.189	1.260	5,500	720	0.027	0.648	4,600	630	0.040	0.648	3,900	144	0.029	0.648
		48	4,600	430	0.093	1.080	4,600	360	0.007	0.315	3,900	310	0.010	0.315	3,300	72	0.007	0.315

Milling Conditions for HLRS (2 Flutes)

WORK MATERIAL			Copper OFC / TPC				PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC)				HARDENED STEELS SKD / SKT (45~55HRC)				HARDENED STEELS SKD / SKH (55~65HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2050	**5**	20	6,700	1,780	0.606	1.980	6,700	1,480	0.092	1.170	4,800	990	0.130	1.170	4,000	297	0.096	1.170
		40	4,600	850	0.297	1.530	4,600	710	0.046	0.900	3,300	470	0.065	0.900	2,800	143	0.048	0.900
2060	**6**	12	8,000	1,800	0.600	2.250	8,000	1,620	0.500	1.350	4,700	1,360	0.200	1.350	4,000	540	0.150	1.350
		20	5,800	1,350	0.580	2.120	5,800	1,180	0.460	1.310	3,500	1,000	0.180	1.310	3,000	380	0.140	1.310
		30	4,500	1,060	0.546	1.980	4,500	880	0.396	1.260	2,600	740	0.158	1.260	2,200	294	0.119	1.260
		60	2,800	530	0.156	1.620	2,800	440	0.113	0.990	1,600	370	0.045	0.990	1,400	147	0.034	0.990

Side Milling
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)



Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Every coolant offers stable milling.
・Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
・Recommend wet coolant for Copper.

4 Flutes HARDMAX

Size **Ø0.8~Ø6**

Additional 40 models

HLRS4000

Super MG | HARD MAX | 30° | R | R ±0.005 | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
○	○	◎	◎	◎	○ ~65HRC	○			○				○		

Total 300 models

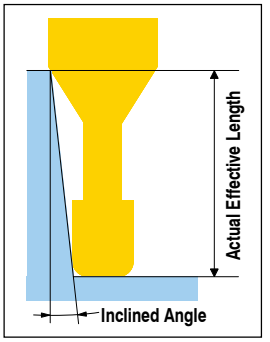
	Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
※	HLRS 4008-002-020	0.8	R0.02	2	0.48	0.78	16°	50	4
※	HLRS 4008-002-030			3				50	4
※	HLRS 4008-002-040			4				50	4
※	HLRS 4008-002-060			6				50	4
※	HLRS 4008-002-080			8				50	4
	HLRS 4008-005-020		R0.05	2				50	4
	HLRS 4008-005-030			3				50	4
	HLRS 4008-005-040			4				50	4
	HLRS 4008-005-060			6				50	4
	HLRS 4008-01-020		R0.1	2				50	4
	HLRS 4008-01-030			3				50	4
	HLRS 4008-01-040			4				50	4
	HLRS 4008-01-060			6				50	4
	HLRS 4008-02-020		R0.2	2				50	4
	HLRS 4008-02-030			3				50	4
	HLRS 4008-02-040			4				50	4
	HLRS 4008-02-060			6				50	4

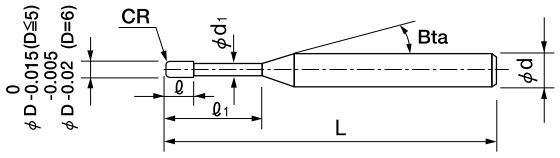
※Additional model

Next Page ➡

Features

Long Neck Radius design for high efficiency and high quality milling.
The rigid tool geometry offers longer tool life when milling Hard Materials.
New and harder HARDMAX coat is adopted maintaining heat resistance, toughness and lubricity at a high level.
Both dry and wet coolant offer stable and long tool life.
Refer to page 288 for 2 flute HLRS.





The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Unit（mm）

	Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
				30'	1°	1°30'	2°	3°
※	HLRS 4008-002-020	0.8	4	2.51	2.70	2.87	3.02	3.29
※	HLRS 4008-002-030		4	3.59	3.82	4.02	4.19	4.51
※	HLRS 4008-002-040		4	4.66	4.92	5.14	5.34	5.74
※	HLRS 4008-002-060		4	6.78	7.10	7.36	7.61	8.19
※	HLRS 4008-002-080		4	8.88	9.25	9.56	9.89	10.63
	HLRS 4008-005-020		4	2.51	2.70	2.86	3.01	3.28
	HLRS 4008-005-030		4	3.59	3.82	4.01	4.19	4.51
	HLRS 4008-005-040		4	4.66	4.92	5.14	5.33	5.73
	HLRS 4008-005-060		4	6.77	7.09	7.35	7.61	8.18
	HLRS 4008-01-020		4	2.51	2.69	2.86	3.00	3.27
	HLRS 4008-01-030		4	3.58	3.81	4.01	4.18	4.50
	HLRS 4008-01-040		4	4.65	4.92	5.13	5.33	5.72
	HLRS 4008-01-060		4	6.77	7.09	7.35	7.60	8.17
	HLRS 4008-02-020		4	2.49	2.68	2.84	2.98	3.25
	HLRS 4008-02-030		4	3.57	3.80	3.99	4.16	4.47
	HLRS 4008-02-040		4	4.64	4.90	5.12	5.31	5.70
	HLRS 4008-02-060		4	6.76	7.08	7.34	7.59	8.14

※Additional model

Next Page ➡

4 Flutes HARDMAX

	Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
※	HLRS 4010-002-020	1	R0.02	2	0.8	0.95	16°	50	4
※	HLRS 4010-002-030			3				50	4
※	HLRS 4010-002-040			4				50	4
※	HLRS 4010-002-050			5				50	4
※	HLRS 4010-002-060			6				50	4
※	HLRS 4010-002-080			8				50	4
※	HLRS 4010-002-100			10				50	4
	HLRS 4010-005-020		R0.05	2				50	4
	HLRS 4010-005-030			3				50	4
	HLRS 4010-005-040			4				50	4
	HLRS 4010-005-050			5				50	4
	HLRS 4010-005-060			6				50	4
	HLRS 4010-005-080			8				50	4
	HLRS 4010-005-100			10				50	4
	HLRS 4010-01-020		R0.1	2				50	4
	HLRS 4010-01-030			3				50	4
	HLRS 4010-01-040			4				50	4
	HLRS 4010-01-050			5				50	4
	HLRS 4010-01-060			6				50	4
	HLRS 4010-01-080			8				50	4
	HLRS 4010-01-100			10				50	4
	HLRS 4010-02-020		R0.2	2				50	4
	HLRS 4010-02-030			3				50	4
	HLRS 4010-02-040			4				50	4
	HLRS 4010-02-050			5				50	4
	HLRS 4010-02-060			6				50	4
	HLRS 4010-02-080			8				50	4
	HLRS 4010-02-100			10				50	4
	HLRS 4010-03-020		R0.3	2				50	4
	HLRS 4010-03-030			3				50	4
	HLRS 4010-03-040			4				50	4
	HLRS 4010-03-050			5				50	4
	HLRS 4010-03-060			6				50	4
	HLRS 4010-03-080			8				50	4
	HLRS 4010-03-100			10				50	4
	HLRS 4012-01-040	1.2	R0.1	4	0.96	1.14	16°	50	4
	HLRS 4012-01-060			6				50	4
	HLRS 4012-01-100			10				50	4
	HLRS 4012-02-040		R0.2	4				50	4
	HLRS 4012-02-060			6				50	4
	HLRS 4012-02-100			10				50	4
	HLRS 4012-03-040		R0.3	4				50	4
	HLRS 4012-03-060			6				50	4
	HLRS 4012-03-100			10				50	4

※Additional model

Next Page ➡

Unit（mm）

	Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
				30'	1°	1°30'	2°	3°
※	HLRS 4010-002-020		4	2.57	2.75	2.90	3.05	3.32
※	HLRS 4010-002-030		4	3.64	3.86	4.05	4.22	4.54
※	HLRS 4010-002-040		4	4.70	4.96	5.17	5.36	5.76
※	HLRS 4010-002-050		4	5.76	6.04	6.28	6.50	6.99
※	HLRS 4010-002-060		4	6.81	7.12	7.38	7.64	8.21
※	HLRS 4010-002-080		4	8.91	9.27	9.58	9.92	10.66
※	HLRS 4010-002-100		4	11.00	11.40	11.78	12.19	13.11
	HLRS 4010-005-020		4	2.56	2.74	2.90	3.05	3.31
	HLRS 4010-005-030		4	3.63	3.85	4.04	4.21	4.53
	HLRS 4010-005-040		4	4.70	4.95	5.17	5.36	5.76
	HLRS 4010-005-050		4	5.76	6.04	6.28	6.50	6.98
	HLRS 4010-005-060		4	6.81	7.12	7.38	7.63	8.20
	HLRS 4010-005-080		4	8.91	9.27	9.58	9.91	10.65
	HLRS 4010-005-100		4	11.00	11.40	11.78	12.19	13.10
	HLRS 4010-01-020		4	2.56	2.74	2.89	3.04	3.30
	HLRS 4010-01-030		4	3.63	3.85	4.04	4.20	4.52
	HLRS 4010-01-040		4	4.70	4.95	5.16	5.35	5.75
	HLRS 4010-01-050	1	4	5.75	6.04	6.27	6.49	6.97
	HLRS 4010-01-060		4	6.81	7.12	7.37	7.63	8.19
	HLRS 4010-01-080		4	8.91	9.26	9.57	9.90	10.64
	HLRS 4010-01-100		4	11.00	11.39	11.77	12.18	13.09
	HLRS 4010-02-020		4	2.55	2.72	2.88	3.02	3.28
	HLRS 4010-02-030		4	3.62	3.84	4.02	4.19	4.50
	HLRS 4010-02-040		4	4.69	4.94	5.15	5.34	5.72
	HLRS 4010-02-050		4	5.75	6.03	6.26	6.47	6.95
	HLRS 4010-02-060		4	6.80	7.11	7.36	7.61	8.17
	HLRS 4010-02-080		4	8.90	9.26	9.56	9.89	10.62
	HLRS 4010-02-100		4	10.99	11.39	11.76	12.17	13.07
	HLRS 4010-03-020		4	2.54	2.71	2.86	3.00	3.25
	HLRS 4010-03-030		4	3.62	3.83	4.01	4.17	4.48
	HLRS 4010-03-040		4	4.68	4.93	5.14	5.32	5.70
	HLRS 4010-03-050		4	5.74	6.02	6.25	6.46	6.93
	HLRS 4010-03-060		4	6.80	7.10	7.35	7.60	8.15
	HLRS 4010-03-080		4	8.90	9.25	9.55	9.88	10.60
	HLRS 4010-03-100		4	10.99	11.38	11.75	12.15	13.04
	HLRS 4012-01-040		4	4.13	4.27	4.41	4.56	4.90
	HLRS 4012-01-060		4	6.20	6.40	6.61	6.84	7.34
	HLRS 4012-01-100		4	10.32	10.66	11.01	11.39	12.24
	HLRS 4012-02-040		4	4.13	4.26	4.40	4.55	4.87
	HLRS 4012-02-060	1.2	4	6.19	6.39	6.60	6.82	7.32
	HLRS 4012-02-100		4	10.32	10.65	11.00	11.38	12.22
	HLRS 4012-03-040		4	4.13	4.25	4.39	4.53	4.85
	HLRS 4012-03-060		4	6.19	6.38	6.59	6.81	7.30
	HLRS 4012-03-100		4	10.32	10.64	10.99	11.36	12.20

※Additional model

Next Page ➡

4 Flutes HARDMAX

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HLRS 4015-005-030	1.5	R0.05	3	1.2	1.45	16°	50	4
HLRS 4015-005-040			4				50	4
HLRS 4015-005-060			6				50	4
HLRS 4015-005-080			8				50	4
HLRS 4015-01-030		R0.1	3				50	4
HLRS 4015-01-040			4				50	4
HLRS 4015-01-060			6				50	4
HLRS 4015-01-080			8				50	4
HLRS 4015-01-100			10				50	4
HLRS 4015-01-120			12				55	4
HLRS 4015-01-160			16				60	4
HLRS 4015-02-030		R0.2	3				50	4
HLRS 4015-02-040			4				50	4
HLRS 4015-02-060			6				50	4
HLRS 4015-02-080			8				50	4
HLRS 4015-02-100			10				50	4
HLRS 4015-02-120			12				55	4
HLRS 4015-02-160			16				60	4
HLRS 4015-03-030		R0.3	3				50	4
HLRS 4015-03-040			4				50	4
HLRS 4015-03-060			6				50	4
HLRS 4015-03-080			8				50	4
HLRS 4015-03-100			10				50	4
HLRS 4015-03-120			12				55	4
HLRS 4015-03-160			16				60	4
HLRS 4015-05-030		R0.5	3				50	4
HLRS 4015-05-040			4				50	4
HLRS 4015-05-060			6				50	4
HLRS 4015-05-080			8				50	4
HLRS 4015-05-100			10				50	4
HLRS 4015-05-120			12				55	4
HLRS 4015-05-160			16				60	4
HLRS 4018-02-080	1.8	R0.2	8	1.44	1.72	16°	50	4
HLRS 4018-02-100			10				50	4
HLRS 4018-02-120			12				55	4
HLRS 4018-02-140			14				55	4
HLRS 4018-02-160			16				60	4
※ HLRS 4020-002-040	2	R0.02	4	1.6	1.92	16°	50	4
※ HLRS 4020-002-060			6				50	4
※ HLRS 4020-002-080			8				50	4
※ HLRS 4020-002-100			10				50	4
※ HLRS 4020-002-120			12				55	4
※ HLRS 4020-002-160			16				60	4
※ HLRS 4020-002-200			20				60	4

※Additional model

Next Page ➡

Unit（mm）

	Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
				30'	1°	1°30'	2°	3°
	HLRS 4015-005-030	1.5	4	3.10	3.20	3.31	3.43	3.68
	HLRS 4015-005-040		4	4.14	4.27	4.41	4.57	4.91
	HLRS 4015-005-060		4	6.20	6.40	6.61	6.84	7.35
	HLRS 4015-005-080		4	8.26	8.53	8.82	9.12	9.80
	HLRS 4015-01-030		4	3.10	3.20	3.31	3.42	3.67
	HLRS 4015-01-040		4	4.13	4.27	4.41	4.56	4.90
	HLRS 4015-01-060		4	6.20	6.40	6.61	6.84	7.34
	HLRS 4015-01-080		4	8.26	8.53	8.81	9.11	9.79
	HLRS 4015-01-100		4	10.32	10.66	11.01	11.39	12.24
	HLRS 4015-01-120		4	12.39	12.79	13.21	13.67	14.69
	HLRS 4015-01-160		4	16.51	17.04	17.61	18.22	19.58
	HLRS 4015-02-030		4	3.10	3.20	3.30	3.41	3.65
	HLRS 4015-02-040		4	4.13	4.26	4.40	4.55	4.87
	HLRS 4015-02-060		4	6.19	6.39	6.60	6.82	7.32
	HLRS 4015-02-080		4	8.26	8.52	8.80	9.10	9.77
	HLRS 4015-02-100		4	10.32	10.65	11.00	11.38	12.22
	HLRS 4015-02-120		4	12.38	12.78	13.20	13.66	14.66
	HLRS 4015-02-160		4	16.51	17.04	17.60	18.21	19.56
	HLRS 4015-03-030		4	3.10	3.19	3.29	3.39	3.63
	HLRS 4015-03-040		4	4.13	4.25	4.39	4.53	4.85
	HLRS 4015-03-060		4	6.19	6.38	6.59	6.81	7.30
	HLRS 4015-03-080		4	8.25	8.51	8.79	9.09	9.75
	HLRS 4015-03-100		4	10.32	10.64	10.99	11.36	12.20
	HLRS 4015-03-120		4	12.38	12.77	13.19	13.64	14.64
	HLRS 4015-03-160		4	16.50	17.03	17.59	18.20	19.54
	HLRS 4015-05-030		4	3.09	3.17	3.27	3.36	3.58
	HLRS 4015-05-040		4	4.12	4.24	4.37	4.50	4.81
	HLRS 4015-05-060		4	6.18	6.37	6.57	6.78	7.25
	HLRS 4015-05-080		4	8.25	8.50	8.77	9.06	9.70
	HLRS 4015-05-100		4	10.31	10.63	10.97	11.34	12.15
	HLRS 4015-05-120		4	12.37	12.76	13.17	13.61	14.60
	HLRS 4015-05-160		4	16.50	17.02	17.57	18.17	19.49
	HLRS 4018-02-080	1.8	4	8.29	8.56	8.84	9.14	9.81
	HLRS 4018-02-100		4	10.36	10.69	11.04	11.42	12.26
	HLRS 4018-02-120		4	12.42	12.82	13.24	13.69	14.71
	HLRS 4018-02-140		4	14.48	14.95	15.44	15.97	17.15
	HLRS 4018-02-160		4	16.54	17.08	17.64	18.25	19.60
※	HLRS 4020-002-040	2	4	4.17	4.31	4.45	4.61	4.96
※	HLRS 4020-002-060		4	6.24	6.44	6.66	6.89	7.40
※	HLRS 4020-002-080		4	8.30	8.57	8.86	9.16	9.85
※	HLRS 4020-002-100		4	10.36	10.70	11.06	11.44	12.30
※	HLRS 4020-002-120		4	12.42	12.83	13.26	13.72	14.75
※	HLRS 4020-002-160		4	16.55	17.09	17.66	18.27	No Interference
※	HLRS 4020-002-200		4	20.67	21.35	22.06	22.83	No Interference

※Additional model

Next Page ➡

4 Flutes HARDMAX

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HLRS 4020-005-040	2	R0.05	4	1.6	1.92	16°	50	4
HLRS 4020-005-060			6				50	4
HLRS 4020-005-080			8				50	4
HLRS 4020-005-100			10				50	4
HLRS 4020-005-120			12				55	4
HLRS 4020-005-160			16				60	4
HLRS 4020-005-200			20				60	4
HLRS 4020-01-040		R0.1	4				50	4
HLRS 4020-01-060			6				50	4
HLRS 4020-01-080			8				50	4
HLRS 4020-01-100			10				50	4
HLRS 4020-01-120			12				55	4
HLRS 4020-01-160			16				60	4
HLRS 4020-01-200			20				60	4
HLRS 4020-02-040		R0.2	4				50	4
HLRS 4020-02-060			6				50	4
HLRS 4020-02-080			8				50	4
HLRS 4020-02-100			10				50	4
HLRS 4020-02-120			12				55	4
HLRS 4020-02-160			16				60	4
HLRS 4020-02-200			20				60	4
HLRS 4020-03-040		R0.3	4				50	4
HLRS 4020-03-060			6				50	4
HLRS 4020-03-080			8				50	4
HLRS 4020-03-100			10				50	4
HLRS 4020-03-120			12				55	4
HLRS 4020-03-160			16				60	4
HLRS 4020-03-200			20				60	4
HLRS 4020-05-040		R0.5	4				50	4
HLRS 4020-05-060			6				50	4
HLRS 4020-05-080			8				50	4
HLRS 4020-05-100			10				50	4
HLRS 4020-05-120			12				55	4
HLRS 4020-05-160			16				60	4
HLRS 4020-05-200			20				60	4
HLRS 4025-01-060	2.5	R0.1	6	2	2.42	16°	50	4
HLRS 4025-01-080			8				50	4
HLRS 4025-01-100			10				50	4
HLRS 4025-01-160			16				60	4
HLRS 4025-01-200			20				60	4
HLRS 4025-01-300			30				70	4
HLRS 4025-02-060		R0.2	6				50	4
HLRS 4025-02-080			8				50	4
HLRS 4025-02-100			10				50	4
HLRS 4025-02-160			16				60	4
HLRS 4025-02-200			20				60	4
HLRS 4025-02-300			30				70	4
HLRS 4025-03-060		R0.3	6				50	4
HLRS 4025-03-080			8				50	4
HLRS 4025-03-100			10				50	4
HLRS 4025-03-160			16				60	4
HLRS 4025-03-200			20				60	4
HLRS 4025-03-300			30				70	4
HLRS 4025-05-060		R0.5	6				50	4
HLRS 4025-05-080			8				50	4
HLRS 4025-05-100			10				50	4
HLRS 4025-05-160			16				60	4
HLRS 4025-05-200			20				60	4
HLRS 4025-05-300			30				70	4

Next Page ➡

Unit（mm）

Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
			30'	1°	1°30'	2°	3°
HLRS 4020-005-040	2	4	4.17	4.31	4.45	4.61	4.95
HLRS 4020-005-060		4	6.23	6.44	6.65	6.88	7.40
HLRS 4020-005-080		4	8.30	8.57	8.85	9.16	9.84
HLRS 4020-005-100		4	10.36	10.70	11.05	11.44	12.29
HLRS 4020-005-120		4	12.42	12.83	13.26	13.72	14.74
HLRS 4020-005-160		4	16.55	17.08	17.66	18.27	No Interference
HLRS 4020-005-200		4	20.67	21.34	22.06	22.82	No Interference
HLRS 4020-01-040		4	4.17	4.30	4.45	4.60	4.94
HLRS 4020-01-060		4	6.23	6.43	6.65	6.88	7.39
HLRS 4020-01-080		4	8.30	8.56	8.85	9.15	9.83
HLRS 4020-01-100		4	10.36	10.69	11.05	11.43	12.28
HLRS 4020-01-120		4	12.42	12.82	13.25	13.71	14.73
HLRS 4020-01-160		4	16.55	17.08	17.65	18.26	No Interference
HLRS 4020-01-200		4	20.67	21.34	22.05	22.82	No Interference
HLRS 4020-02-040		4	4.17	4.30	4.44	4.59	4.92
HLRS 4020-02-060		4	6.23	6.43	6.64	6.86	7.36
HLRS 4020-02-080		4	8.29	8.56	8.84	9.14	9.81
HLRS 4020-02-100		4	10.36	10.69	11.04	11.42	12.26
HLRS 4020-02-120		4	12.42	12.82	13.24	13.69	14.71
HLRS 4020-02-160		4	16.54	17.08	17.64	18.25	19.60
HLRS 4020-02-200		4	20.67	21.33	22.04	22.80	No Interference
HLRS 4020-03-040		4	4.16	4.29	4.43	4.57	4.90
HLRS 4020-03-060		4	6.23	6.42	6.63	6.85	7.34
HLRS 4020-03-080		4	8.29	8.55	8.83	9.13	9.79
HLRS 4020-03-100		4	10.35	10.68	11.03	11.40	12.24
HLRS 4020-03-120		4	12.41	12.81	13.23	13.68	14.68
HLRS 4020-03-160		4	16.54	17.07	17.63	18.24	19.58
HLRS 4020-03-200		4	20.67	21.33	22.03	22.79	No Interference
HLRS 4020-05-040		4	4.16	4.28	4.40	4.54	4.85
HLRS 4020-05-060		4	6.22	6.41	6.61	6.82	7.30
HLRS 4020-05-080		4	8.28	8.54	8.81	9.10	9.74
HLRS 4020-05-100		4	10.34	10.67	11.01	11.37	12.19
HLRS 4020-05-120		4	12.41	12.79	13.21	13.65	14.64
HLRS 4020-05-160		4	16.53	17.05	17.61	18.21	19.53
HLRS 4020-05-200		4	20.66	21.31	22.01	22.76	No Interference
HLRS 4025-01-060	2.5	4	6.23	6.43	6.65	6.88	7.39
HLRS 4025-01-080		4	8.30	8.56	8.85	9.15	9.83
HLRS 4025-01-100		4	10.36	10.69	11.05	11.43	12.28
HLRS 4025-01-160		4	16.55	17.08	17.65	18.26	No Interference
HLRS 4025-01-200		4	20.67	21.34	22.05	No Interference	No Interference
HLRS 4025-01-300		4	30.99	31.99	No Interference	No Interference	No Interference
HLRS 4025-02-060		4	6.23	6.43	6.64	6.86	7.36
HLRS 4025-02-080		4	8.29	8.56	8.84	9.14	9.81
HLRS 4025-02-100		4	10.36	10.69	11.04	11.42	12.26
HLRS 4025-02-160		4	16.54	17.08	17.64	18.25	No Interference
HLRS 4025-02-200		4	20.67	21.33	22.04	No Interference	No Interference
HLRS 4025-02-300		4	30.98	31.98	No Interference	No Interference	No Interference
HLRS 4025-03-060		4	6.23	6.42	6.63	6.85	7.34
HLRS 4025-03-080		4	8.29	8.55	8.83	9.13	9.79
HLRS 4025-03-100		4	10.35	10.68	11.03	11.40	12.24
HLRS 4025-03-160		4	16.54	17.07	17.63	18.24	No Interference
HLRS 4025-03-200		4	20.67	21.33	22.03	No Interference	No Interference
HLRS 4025-03-300		4	30.98	31.98	No Interference	No Interference	No Interference
HLRS 4025-05-060		4	6.22	6.41	6.61	6.82	7.30
HLRS 4025-05-080		4	8.28	8.54	8.81	9.10	9.74
HLRS 4025-05-100		4	10.34	10.67	11.01	11.37	12.19
HLRS 4025-05-160		4	16.53	17.05	17.61	18.21	No Interference
HLRS 4025-05-200		4	20.66	21.31	22.01	No Interference	No Interference
HLRS 4025-05-300		4	30.97	31.96	No Interference	No Interference	No Interference

Next Page ➡

4 Flutes HARDMAX

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HLRS 4030-005-040	3	R0.05	4	2.4	2.92	16°	55	6
HLRS 4030-005-060			6				55	6
HLRS 4030-005-080			8				55	6
HLRS 4030-005-100			10				55	6
HLRS 4030-005-120			12				55	6
HLRS 4030-005-160			16				60	6
HLRS 4030-005-200			20				60	6
HLRS 4030-01-040		R0.1	4				55	6
HLRS 4030-01-060			6				55	6
HLRS 4030-01-080			8				55	6
HLRS 4030-01-100			10				55	6
HLRS 4030-01-120			12				55	6
HLRS 4030-01-160			16				60	6
HLRS 4030-01-200			20				60	6
HLRS 4030-01-260			26				70	6
HLRS 4030-01-300			30				70	6
HLRS 4030-02-040		R0.2	4				55	6
HLRS 4030-02-060			6				55	6
HLRS 4030-02-080			8				55	6
HLRS 4030-02-100			10				55	6
HLRS 4030-02-120			12				55	6
HLRS 4030-02-160			16				60	6
HLRS 4030-02-200			20				60	6
HLRS 4030-02-260			26				70	6
HLRS 4030-02-300			30				70	6
HLRS 4030-03-040		R0.3	4				55	6
HLRS 4030-03-060			6				55	6
HLRS 4030-03-080			8				55	6
HLRS 4030-03-100			10				55	6
HLRS 4030-03-120			12				55	6
HLRS 4030-03-140			14				55	6
HLRS 4030-03-160			16				60	6
HLRS 4030-03-200			20				60	6
HLRS 4030-03-260			26				70	6
HLRS 4030-03-300			30				70	6
HLRS 4030-05-040		R0.5	4				55	6
HLRS 4030-05-060			6				55	6
HLRS 4030-05-080			8				55	6
HLRS 4030-05-100			10				55	6
HLRS 4030-05-120			12				55	6
HLRS 4030-05-160			16				60	6
HLRS 4030-05-200			20				60	6
HLRS 4030-05-260			26				70	6
HLRS 4030-05-300			30				70	6
HLRS 4030-10-060		R1	6				55	6
HLRS 4030-10-080			8				55	6
HLRS 4030-10-100			10				55	6
HLRS 4030-10-120			12				55	6
HLRS 4030-10-160			16				60	6
HLRS 4030-10-200			20				60	6
HLRS 4030-10-260			26				70	6
HLRS 4030-10-300			30				70	6

Next Page ➡

Unit（mm）

Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
			30'	1°	1°30'	2°	3°
HLRS 4030-005-040		6	4.17	4.31	4.45	4.60	4.95
HLRS 4030-005-060		6	6.23	6.43	6.65	6.88	7.40
HLRS 4030-005-080		6	8.30	8.56	8.85	9.16	9.84
HLRS 4030-005-100		6	10.36	10.69	11.05	11.44	12.29
HLRS 4030-005-120		6	12.42	12.82	13.25	13.71	14.74
HLRS 4030-005-160		6	16.55	17.08	17.66	18.27	19.63
HLRS 4030-005-200		6	20.67	21.34	22.06	22.82	24.53
HLRS 4030-01-040		6	4.17	4.30	4.44	4.60	4.94
HLRS 4030-01-060		6	6.23	6.43	6.65	6.87	7.38
HLRS 4030-01-080		6	8.29	8.56	8.85	9.15	9.83
HLRS 4030-01-100		6	10.36	10.69	11.05	11.43	12.28
HLRS 4030-01-120		6	12.42	12.82	13.25	13.71	14.73
HLRS 4030-01-160		6	16.54	17.08	17.65	18.26	19.62
HLRS 4030-01-200		6	20.67	21.34	22.05	22.82	24.52
HLRS 4030-01-260		6	26.86	27.73	28.66	29.65	No Interference
HLRS 4030-01-300		6	30.98	31.99	33.06	34.20	No Interference
HLRS 4030-02-040		6	4.17	4.30	4.43	4.58	4.92
HLRS 4030-02-060		6	6.23	6.43	6.64	6.86	7.36
HLRS 4030-02-080		6	8.29	8.55	8.84	9.14	9.81
HLRS 4030-02-100		6	10.35	10.68	11.04	11.42	12.26
HLRS 4030-02-120		6	12.42	12.81	13.24	13.69	14.70
HLRS 4030-02-160		6	16.54	17.07	17.64	18.25	19.60
HLRS 4030-02-200		6	20.67	21.33	22.04	22.80	24.49
HLRS 4030-02-260		6	26.86	27.72	28.65	29.63	No Interference
HLRS 4030-02-300		6	30.98	31.98	33.05	34.19	No Interference
HLRS 4030-03-040	3	6	4.16	4.29	4.42	4.57	4.89
HLRS 4030-03-060		6	6.22	6.42	6.63	6.85	7.34
HLRS 4030-03-080		6	8.29	8.55	8.83	9.12	9.79
HLRS 4030-03-100		6	10.35	10.68	11.03	11.40	12.24
HLRS 4030-03-120		6	12.41	12.81	13.23	13.68	14.68
HLRS 4030-03-140		6	14.48	14.94	15.43	15.96	17.13
HLRS 4030-03-160		6	16.54	17.07	17.63	18.23	19.58
HLRS 4030-03-200		6	20.66	21.33	22.03	22.79	24.47
HLRS 4030-03-260		6	26.85	27.71	28.64	29.62	No Interference
HLRS 4030-03-300		6	30.98	31.97	33.04	34.18	No Interference
HLRS 4030-05-040		6	4.15	4.27	4.40	4.54	4.85
HLRS 4030-05-060		6	6.22	6.40	6.60	6.82	7.30
HLRS 4030-05-080		6	8.28	8.53	8.80	9.10	9.74
HLRS 4030-05-100		6	10.34	10.66	11.01	11.37	12.19
HLRS 4030-05-120		6	12.40	12.79	13.21	13.65	14.64
HLRS 4030-05-160		6	16.53	17.05	17.61	18.20	19.53
HLRS 4030-05-200		6	20.66	21.31	22.01	22.76	24.43
HLRS 4030-05-260		6	26.84	27.70	28.61	29.59	No Interference
HLRS 4030-05-300		6	30.97	31.96	33.02	34.15	No Interference
HLRS 4030-10-060		6	6.20	6.37	6.55	6.75	7.18
HLRS 4030-10-080		6	8.26	8.50	8.75	9.03	9.63
HLRS 4030-10-100		6	10.32	10.63	10.95	11.30	12.08
HLRS 4030-10-120		6	12.39	12.76	13.16	13.58	14.53
HLRS 4030-10-160		6	16.51	17.02	17.56	18.13	19.42
HLRS 4030-10-200		6	20.64	21.28	21.96	22.69	24.32
HLRS 4030-10-260		6	26.83	27.67	28.56	29.52	No Interference
HLRS 4030-10-300		6	30.95	31.93	32.96	34.08	No Interference

Next Page ➡

4 Flutes HARDMAX

	Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
※	HLRS 4040-005-080	4	R0.05	8	3.2	3.82	16°	65	6
※	HLRS 4040-005-120			12				65	6
※	HLRS 4040-005-160			16				65	6
※	HLRS 4040-005-200			20				70	6
※	HLRS 4040-005-240			24				70	6
※	HLRS 4040-005-320			32				80	6
	HLRS 4040-01-080		R0.1	8				65	6
	HLRS 4040-01-120			12				65	6
	HLRS 4040-01-160			16				65	6
	HLRS 4040-01-200			20				70	6
	HLRS 4040-01-240			24				70	6
	HLRS 4040-01-320			32				80	6
	HLRS 4040-02-080		R0.2	8				65	6
	HLRS 4040-02-120			12				65	6
	HLRS 4040-02-160			16				65	6
	HLRS 4040-02-200			20				70	6
	HLRS 4040-02-240			24				70	6
	HLRS 4040-02-320			32				80	6
	HLRS 4040-03-080		R0.3	8				65	6
	HLRS 4040-03-120			12				65	6
	HLRS 4040-03-140			14				65	6
	HLRS 4040-03-160			16				65	6
	HLRS 4040-03-200			20				70	6
	HLRS 4040-03-240			24				70	6
	HLRS 4040-03-320			32				80	6
	HLRS 4040-05-080		R0.5	8				65	6
	HLRS 4040-05-120			12				65	6
	HLRS 4040-05-160			16				65	6
	HLRS 4040-05-200			20				70	6
	HLRS 4040-05-240			24				70	6
	HLRS 4040-05-320			32				80	6
	HLRS 4040-10-080		R1	8				65	6
	HLRS 4040-10-120			12				65	6
	HLRS 4040-10-160			16				65	6
	HLRS 4040-10-200			20				70	6
	HLRS 4040-10-240			24				70	6
	HLRS 4040-10-320			32				80	6
※	HLRS 4050-01-160	5	R0.1	16	4	4.82	16°	65	6
※	HLRS 4050-01-200			20				70	6
※	HLRS 4050-01-400			40				100	6
※	HLRS 4050-02-160		R0.2	16				65	6
※	HLRS 4050-02-200			20				70	6
※	HLRS 4050-02-400			40				100	6
※	HLRS 4050-03-160		R0.3	16				65	6
※	HLRS 4050-03-200			20				70	6
※	HLRS 4050-03-400			40				100	6
※	HLRS 4050-05-160		R0.5	16				65	6
※	HLRS 4050-05-200			20				70	6
※	HLRS 4050-05-400			40				100	6
※	HLRS 4050-10-160		R1	16				65	6
※	HLRS 4050-10-200			20				70	6
※	HLRS 4050-10-400			40				100	6

※Additional model

Next Page ➡

Unit（mm）

	Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
				30'	1°	1°30'	2°	3°
※	HLRS 4040-005-080		6	8.48	8.75	9.04	9.36	10.06
※	HLRS 4040-005-120		6	12.60	13.01	13.45	13.91	14.95
※	HLRS 4040-005-160		6	16.73	17.27	17.85	18.47	No Interference
※	HLRS 4040-005-200		6	20.85	21.53	22.25	23.02	No Interference
※	HLRS 4040-005-240		6	24.98	25.79	26.65	27.58	No Interference
※	HLRS 4040-005-320		6	33.23	34.31	35.46	No Interference	No Interference
	HLRS 4040-01-080		6	8.47	8.75	9.04	9.35	10.05
	HLRS 4040-01-120		6	12.60	13.01	13.44	13.91	14.94
	HLRS 4040-01-160		6	16.72	17.27	17.84	18.46	No Interference
	HLRS 4040-01-200		6	20.85	21.52	22.24	23.01	No Interference
	HLRS 4040-01-240		6	24.98	25.78	26.65	27.57	No Interference
	HLRS 4040-01-320		6	33.23	34.30	35.45	No Interference	No Interference
	HLRS 4040-02-080		6	8.47	8.74	9.03	9.34	10.02
	HLRS 4040-02-120		6	12.60	13.00	13.43	13.89	14.92
	HLRS 4040-02-160		6	16.72	17.26	17.83	18.45	No Interference
	HLRS 4040-02-200		6	20.85	21.52	22.23	23.00	No Interference
	HLRS 4040-02-240		6	24.97	25.78	26.64	27.56	No Interference
	HLRS 4040-02-320		6	33.22	34.30	35.44	No Interference	No Interference
	HLRS 4040-03-080	4	6	8.47	8.73	9.02	9.32	10.00
	HLRS 4040-03-120		6	12.59	12.99	13.42	13.88	14.90
	HLRS 4040-03-140		6	14.66	15.12	15.62	16.16	17.34
	HLRS 4040-03-160		6	16.72	17.25	17.82	18.43	No Interference
	HLRS 4040-03-200		6	20.84	21.51	22.22	22.99	No Interference
	HLRS 4040-03-240		6	24.97	25.77	26.63	27.54	No Interference
	HLRS 4040-03-320		6	33.22	34.29	35.43	No Interference	No Interference
	HLRS 4040-05-080		6	8.46	8.72	9.00	9.29	9.96
	HLRS 4040-05-120		6	12.58	12.98	13.40	13.85	14.85
	HLRS 4040-05-160		6	16.71	17.24	17.80	18.40	19.75
	HLRS 4040-05-200		6	20.84	21.50	22.20	22.96	No Interference
	HLRS 4040-05-240		6	24.96	25.76	26.60	27.51	No Interference
	HLRS 4040-05-320		6	33.21	34.27	35.41	No Interference	No Interference
	HLRS 4040-10-080		6	8.44	8.69	8.95	9.22	9.84
	HLRS 4040-10-120		6	12.57	12.94	13.35	13.78	14.74
	HLRS 4040-10-160		6	16.69	17.20	17.75	18.33	19.63
	HLRS 4040-10-200		6	20.82	21.46	22.15	22.89	No Interference
	HLRS 4040-10-240		6	24.94	25.72	26.55	27.44	No Interference
	HLRS 4040-10-320		6	33.20	34.24	35.36	No Interference	No Interference
※	HLRS 4050-01-160		6	16.72	17.27	17.84	No Interference	No Interference
※	HLRS 4050-01-200		6	20.85	21.52	No Interference	No Interference	No Interference
※	HLRS 4050-01-400		6	41.48	No Interference	No Interference	No Interference	No Interference
※	HLRS 4050-02-160		6	16.72	17.26	17.83	No Interference	No Interference
※	HLRS 4050-02-200		6	20.85	21.52	No Interference	No Interference	No Interference
※	HLRS 4050-02-400		6	41.47	No Interference	No Interference	No Interference	No Interference
※	HLRS 4050-03-160		6	16.72	17.25	17.82	No Interference	No Interference
※	HLRS 4050-03-200	5	6	20.84	21.51	No Interference	No Interference	No Interference
※	HLRS 4050-03-400		6	41.47	No Interference	No Interference	No Interference	No Interference
※	HLRS 4050-05-160		6	16.71	17.24	17.80	No Interference	No Interference
※	HLRS 4050-05-200		6	20.83	21.50	No Interference	No Interference	No Interference
※	HLRS 4050-05-400		6	41.46	No Interference	No Interference	No Interference	No Interference
※	HLRS 4050-10-160		6	16.69	17.20	17.74	No Interference	No Interference
※	HLRS 4050-10-200		6	20.81	21.46	No Interference	No Interference	No Interference
※	HLRS 4050-10-400		6	41.44	No Interference	No Interference	No Interference	No Interference

※Additional model

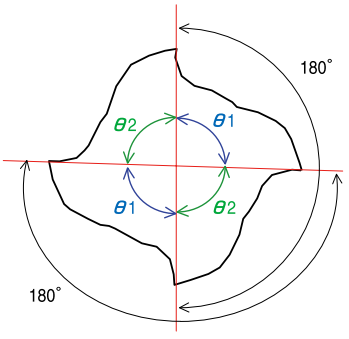
Next Page ➡

4 Flutes HARDMAX

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HLRS 4060-01-120	6	R0.1	12	4.8	5.82	–	65	6
HLRS 4060-01-160			16				65	6
HLRS 4060-01-200			20				70	6
HLRS 4060-01-240			24				70	6
HLRS 4060-01-300			30				100	6
HLRS 4060-01-480			48				120	6
HLRS 4060-02-120		R0.2	12				65	6
HLRS 4060-02-160			16				65	6
HLRS 4060-02-200			20				70	6
HLRS 4060-02-240			24				70	6
HLRS 4060-02-300			30				100	6
HLRS 4060-02-480			48				120	6
HLRS 4060-03-120		R0.3	12				65	6
HLRS 4060-03-160			16				65	6
HLRS 4060-03-200			20				70	6
HLRS 4060-03-240			24				70	6
HLRS 4060-03-300			30				100	6
HLRS 4060-03-480			48				120	6
HLRS 4060-05-120		R0.5	12				65	6
HLRS 4060-05-160			16				65	6
HLRS 4060-05-200			20				70	6
HLRS 4060-05-240			24				70	6
HLRS 4060-05-300			30				100	6
HLRS 4060-05-400			40				100	6
HLRS 4060-05-480			48				120	6
HLRS 4060-10-120		R1	12				65	6
HLRS 4060-10-160			16				65	6
HLRS 4060-10-200			20				70	6
HLRS 4060-10-240			24				70	6
HLRS 4060-10-300			30				100	6
HLRS 4060-10-400			40				100	6
HLRS 4060-10-480			48				120	6

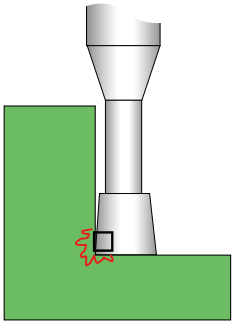
Next Page ➡

Variable pitch



The unequal division reduces chattering and tip damage.
Easy to measure outside diameter.

Back taper geometry



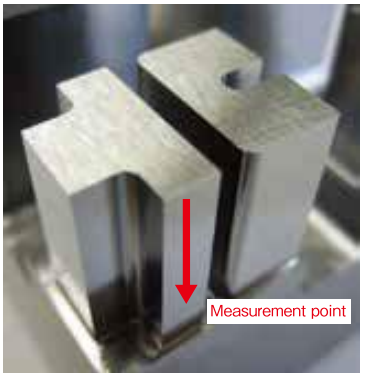
The back taper geometry reduces cutting resistance.

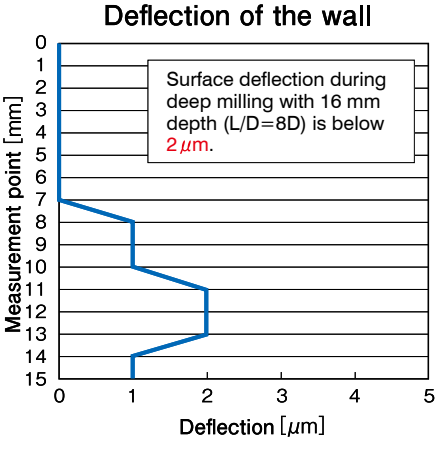
Unit（mm）

Model Number	Outside Diameter ØD	Shank Diameter Ød	Effective Length by Inclined Angles				
			30'	1°	1°30'	2°	3°
HLRS 4060-01-120	6	6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-01-160		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-01-200		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-01-240		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-01-300		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-01-480		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-02-120		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-02-160		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-02-200		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-02-240		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-02-300		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-02-480		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-03-120		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-03-160		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-03-200		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-03-240		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-03-300		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-03-480		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-05-120		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-05-160		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-05-200		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-05-240		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-05-300		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-05-400		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-05-480		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-10-120		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-10-160		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-10-200		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-10-240		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-10-300		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-10-400		6	No Interference	No Interference	No Interference	No Interference	No Interference
HLRS 4060-10-480		6	No Interference	No Interference	No Interference	No Interference	No Interference

Next Page ➡

L / D = 8D Milling Example for Slotting: DAC10（48HRC）HLRS4020-03-160（Ø2 x CR0.3 x Effective Length 16 mm）





Spindle Speed	7,300 min^{-1}
Feed Rate	1,260 mm/min
Axial Depth a_p	0.02 mm
Radial Depth a_e	0.015 mm
Cycle Time	112 minutes
Coolant	Oil Mist
Work Material Size	20 × 15 mm

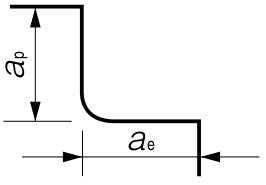
Milling Conditions for HLRS (4 Flutes)

WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC)				HARDENED STEELS SKD / SKT (45~55HRC)				HARDENED STEELS SKD / SKH (55~65HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4008	**0.8**	2	20,000	1,100	0.025	0.2	18,500	950	0.02	0.2	10,000	280	0.005	0.12
		3	18,800	950	0.021	0.2	16,500	830	0.018	0.2	9,200	200	0.005	0.116
		4	17,500	840	0.018	0.2	15,000	730	0.016	0.2	8,800	120	0.004	0.112
		6	14,600	700	0.015	0.2	12,500	600	0.015	0.2	8,500	60	0.004	0.108
		8	13,100	450	0.008	0.13	11,150	425	0.008	0.125	7,500	50	0.003	0.057
4010	**1**	2	17,600	1,470	0.056	0.270	15,300	1,200	0.038	0.270	10,900	710	0.030	0.270
		3	15,500	1,390	0.048	0.270	13,200	1,150	0.037	0.270	9,400	680	0.027	0.270
		4	13,800	1,310	0.039	0.270	12,000	1,070	0.031	0.243	8,500	640	0.015	0.243
		5	12,500	1,150	0.030	0.240	11,000	960	0.027	0.232	7,800	570	0.013	0.144
		6	11,300	1,040	0.021	0.216	9,800	860	0.016	0.209	7,000	510	0.010	0.108
		8	9,800	780	0.020	0.189	8,500	720	0.012	0.160	6,100	420	0.008	0.094
		10	8,800	510	0.011	0.126	7,600	510	0.009	0.100	5,400	350	0.006	0.050
4012	**1.2**	4	13,200	1,360	0.032	0.450	11,900	1,100	0.024	0.300	9,200	1,300	0.020	0.200
		6	11,200	1,160	0.028	0.360	9,600	980	0.022	0.252	7,400	1,200	0.011	0.095
		10	9,000	800	0.017	0.180	7,300	600	0.009	0.150	6,300	800	0.006	0.050
4015	**1.5**	3	16,400	1,520	0.063	0.569	14,800	1,330	0.052	0.540	11,200	780	0.035	0.315
		4	13,200	1,360	0.054	0.540	13,200	1,280	0.042	0.495	10,100	700	0.033	0.292
		6	11,600	1,280	0.041	0.486	10,600	1,210	0.038	0.445	8,100	460	0.025	0.202
		8	10,200	1,080	0.037	0.378	9,300	1,020	0.031	0.346	7,100	390	0.015	0.157
		10	9,300	930	0.032	0.345	8,500	870	0.029	0.316	6,600	340	0.011	0.172
		12	8,500	830	0.029	0.324	7,800	780	0.026	0.297	5,900	300	0.010	0.162
		16	7,400	670	0.018	0.216	6,800	600	0.014	0.198	5,100	230	0.005	0.108
4018	**1.8**	8	10,700	1,120	0.047	0.495	9,800	1,060	0.043	0.497	7,700	500	0.020	0.222
		10	9,600	1,010	0.040	0.436	8,900	950	0.038	0.421	7,100	390	0.015	0.203
		12	8,100	850	0.035	0.303	7,500	740	0.032	0.306	5,900	290	0.013	0.159
		14	7,400	770	0.027	0.240	6,900	660	0.024	0.240	5,400	270	0.008	0.130
		16	7,200	730	0.021	0.207	6,700	630	0.019	0.198	5,200	260	0.006	0.113
4020	**2**	4	15,300	1,570	0.069	0.720	14,300	1,460	0.065	0.810	11,500	860	0.031	0.360
		6	12,800	1,280	0.064	0.648	12,000	1,200	0.060	0.729	9,700	700	0.028	0.324
		8	11,200	1,160	0.058	0.612	10,400	1,100	0.055	0.648	8,400	600	0.026	0.288
		10	10,000	1,090	0.049	0.526	9,300	1,020	0.047	0.526	7,600	450	0.019	0.234
		12	9,100	1,030	0.046	0.405	8,500	960	0.044	0.405	6,900	420	0.018	0.180
		16	7,800	860	0.042	0.283	7,300	700	0.039	0.315	5,900	270	0.016	0.157
		20	7,000	800	0.025	0.198	6,600	650	0.024	0.198	5,300	290	0.007	0.118
4025	**2.5**	6	13,000	1,600	0.078	0.700	12,000	1,500	0.074	0.700	9,900	830	0.050	0.476
		8	11,300	1,430	0.075	0.620	10,500	1,240	0.072	0.620	9,100	650	0.050	0.420
		10	10,500	1,400	0.067	0.540	10,000	1,150	0.067	0.540	8,400	510	0.048	0.324
		16	8,900	1,400	0.059	0.360	8,500	790	0.049	0.300	7,200	350	0.030	0.150
		20	7,800	1,200	0.048	0.270	7,500	670	0.031	0.225	6,300	300	0.022	0.090
		30	6,300	600	0.011	0.180	6,000	500	0.014	0.180	5,000	220	0.010	0.054

Milling Conditions for HLRS (4 Flutes)

WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC)				HARDENED STEELS SKD / SKT (45~55HRC)				HARDENED STEELS SKD / SKH (55~65HRC)			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4030	3	4	15,000	3,070	0.128	0.720	14,000	2,640	0.080	0.720	11,500	980	0.052	0.576
		6	14,000	2,890	0.120	0.720	13,300	2,500	0.075	0.720	10,800	900	0.050	0.576
		8	12,500	2,530	0.105	0.700	11,800	2,200	0.070	0.700	9,900	810	0.047	0.560
		10	11,300	2,160	0.096	0.700	10,500	2,090	0.060	0.700	9,000	730	0.045	0.560
		12	10,500	2,020	0.084	0.670	10,000	1,950	0.052	0.670	8,100	660	0.037	0.502
		14	9,700	1,800	0.072	0.650	9,300	1,700	0.044	0.650	7,500	600	0.032	0.430
		16	9,200	1,680	0.064	0.630	8,800	1,600	0.040	0.630	7,100	570	0.027	0.378
		20	8,400	1,540	0.058	0.580	7,900	1,490	0.036	0.580	6,300	550	0.022	0.319
		26	7,500	1,440	0.046	0.446	7,100	1,360	0.023	0.446	5,700	480	0.012	0.198
		30	7,000	1,260	0.040	0.380	6,500	1,230	0.015	0.380	5,400	390	0.007	0.144
4040	4	8	10,200	1,480	0.133	1.350	8,500	1,420	0.104	1.350	7,300	810	0.091	0.945
		12	8,900	1,440	0.116	1.150	7,600	1,390	0.091	1.150	6,400	780	0.065	0.805
		14	8,500	1,400	0.100	1.080	7,100	1,350	0.078	1.080	6,000	760	0.051	0.760
		16	7,900	1,370	0.091	1.000	6,600	1,330	0.071	1.000	5,600	740	0.043	0.700
		20	6,900	1,320	0.076	0.900	5,800	1,260	0.059	0.900	4,900	720	0.032	0.630
		24	6,200	1,200	0.060	0.800	5,200	1,120	0.047	0.800	4,500	630	0.022	0.560
		32	5,500	960	0.037	0.648	4,600	920	0.029	0.648	3,900	600	0.011	0.388
4050	5	16	7,200	1,700	0.150	1.500	5,300	1,200	0.125	1.150	4,200	820	0.063	1.030
		20	6,700	1,500	0.140	1.400	4,800	1,100	0.100	1.100	4,000	740	0.045	1.000
		40	4,600	880	0.068	1.000	3,300	700	0.060	0.680	2,800	500	0.025	0.440
4060	6	12	8,000	2,370	0.200	2.430	4,700	1,360	0.200	1.350	4,000	1,080	0.075	1.350
		16	6,700	2,020	0.190	2.394	4,000	1,150	0.190	1.330	3,400	900	0.073	1.330
		20	5,800	1,730	0.180	2.358	3,500	1,000	0.180	1.310	3,000	760	0.070	1.310
		24	5,200	1,540	0.170	2.322	3,100	860	0.170	1.290	2,700	680	0.068	1.290
		30	4,500	1,290	0.158	2.268	2,600	740	0.158	1.260	2,200	580	0.066	1.260
		40	3,000	800	0.100	1.350	1,700	480	0.100	0.750	1,400	360	0.040	0.550
		48	2,000	510	0.050	0.900	1,200	330	0.040	0.500	1,000	240	0.020	0.300

Side Milling
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)



Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Every coolant offers stable milling.
・Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
・Recommend wet coolant for Copper.

4 Flutes HARDMAX

Size **Ø2~Ø12**

HRRS

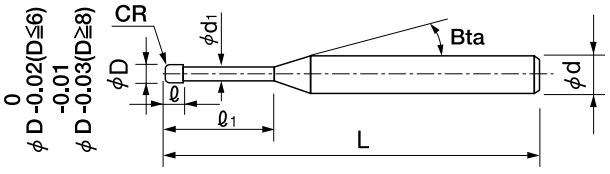
Super MG | HARD MAX | 45° | R | R ±0.01 (Ø2~Ø6) | R ±0.015 (Ø8~Ø12) | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
		◎	◎	◎	○ ~65HRC	○									

Features

Special corner radius geometry offers greater milling amount and larger step over than a ball design.
Seamless corner radius reduces cutting resistance and chattering.
Rated to 65HRC milling.



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 49 model — **Unit (mm)**

	Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
	HRRS 4020-03-06	2	R0.3	6	2	1.91	16°	70	4
	HRRS 4020-05-06		R0.5					70	4
◎	HRRS 4030-08-09-3	3	R0.8	9	3	2.92	-	70	3
	HRRS 4030-08-09			2			16°	70	6
	HRRS 4040-03-12-6	4	R0.3	12	4	3.82	16°	70	6
	HRRS 4040-03-20-6			20				70	6
◎	HRRS 4040-05-12		R0.5	12	4	3.82	-	70	4
	HRRS 4040-05-12-6						16°	70	6
	HRRS 4040-05-20-6			20				70	6
◎	HRRS 4040-10-12		R1.0	12	4	3.82	-	70	4
	HRRS 4040-10-12-6						16°	70	6
	HRRS 4040-10-20-6			20				70	6

◎ Straight shank type

Next Page ➡

Unit（mm）

Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HRRS 4050-12-15	5	R1.2	15	5	4.82	16°	70	6
◎ HRRS 4060-03-18	6	R0.3	8	6	5.82	-	90	6
◎ HRRS 4060-03-30			30				90	6
◎ HRRS 4060-05-18		R0.5	18				90	6
◎ HRRS 4060-05-30			30				90	6
◎ HRRS 4060-10-18		R1.0	18				90	6
◎ HRRS 4060-10-30			30				90	6
◎ HRRS 4060-15-18		R1.5	18				90	6
◎ HRRS 4060-15-30			30				90	6
◎ HRRS 4060-20-18		R2.0	18				90	6
◎ HRRS 4080-03-24	8	R0.3	4	8	7.82	-	100	8
◎ HRRS 4080-03-40			40				100	8
◎ HRRS 4080-05-24		R0.5	24				100	8
◎ HRRS 4080-05-40			40				100	8
◎ HRRS 4080-10-24		R1.0	24				100	8
◎ HRRS 4080-10-40			40				100	8
◎ HRRS 4080-20-24		R2.0	24				100	8
◎ HRRS 4080-20-40			40				100	8
◎ HRRS 4080-30-24		R3.0	24				100	8
◎ HRRS 4100-03-30	10	R0.3	30	10	9.82	-	110	10
◎ HRRS 4100-03-50			50				110	10
◎ HRRS 4100-05-30		R0.5	30				110	10
◎ HRRS 4100-05-50			50				110	10
◎ HRRS 4100-10-30		R1.0	30				110	10
◎ HRRS 4100-10-50			50				110	10
◎ HRRS 4100-20-30		R2.0	30				110	10
◎ HRRS 4100-20-50			50				110	10
◎ HRRS 4100-30-30		R3.0	30				110	10
◎ HRRS 4120-03-36	12	R0.3	36	12	11.82	-	120	12
◎ HRRS 4120-03-60			60				120	12
◎ HRRS 4120-05-36		R0.5	36				120	12
◎ HRRS 4120-05-60			60				120	12
◎ HRRS 4120-10-36		R1.0	36				120	12
◎ HRRS 4120-10-60			60				120	12
◎ HRRS 4120-20-36		R2.0	36				120	12
◎ HRRS 4120-20-60			60				120	12
◎ HRRS 4120-40-36		R4.0	36				120	12

◎Straight shank type

Milling Conditions for HRRS / HRRS-S

◆Roughing Effective length 3D

WORK MATERIAL			PREHARDENED STEELS / HARDENED STEELS (30～45HRC) (Air Blow/Oil Mist)				HARDENED STEELS (45～55HRC) (Air Blow/Oil Mist)				HARDENED STEELS (55～65HRC) (Air Blow/Oil Mist)			
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4020-03-06	**2**	R0.3	30,000	7,650	0.03	0.41	10,000	2,160	0.08	0.36	8,000	1,170	0.04	0.36
4020-05-06		R0.5	30,000	7,650	0.05	0.72	10,000	2,160	0.14	0.63	8,000	1,170	0.07	0.63
4030-08-09	**3**	R0.8	25,000	8,100	0.07	1.08	10,000	2,970	0.16	0.95	7,000	1,710	0.09	0.95
4040-03-12-6	**4**	R0.3	15,000	8,550	0.05	0.66	9,000	3,600	0.08	0.62	6,000	2,160	0.04	0.62
4040-05-12		R0.5	15,000	8,550	0.06	0.82	9,000	3,600	0.10	0.77	6,000	2,160	0.05	0.77
4040-10-12		R1	15,000	8,550	0.11	1.44	9,000	3,600	0.16	1.35	6,000	2,160	0.09	1.35
4050-12-15	**5**	R1.2	10,000	8,550	0.16	1.80	8,000	4,950	0.18	1.58	6,000	2,160	0.14	1.58
4060-03-18	**6**	R0.3	9,000	8,550	0.08	0.98	8,000	5,400	0.09	0.87	6,000	2,070	0.08	0.87
4060-05-18		R0.5	9,000	8,550	0.10	1.23	8,000	5,400	0.11	1.08	6,000	2,070	0.11	1.08
4060-10-18		R1	9,000	8,550	0.14	1.57	8,000	5,400	0.14	1.49	6,000	2,070	0.14	1.49
4060-15-18		R1.5	9,000	8,550	0.17	2.16	8,000	5,400	0.18	1.89	6,000	2,070	0.18	1.89
4060-20-18		R2	9,000	8,550	0.17	2.30	8,000	5,400	0.18	2.02	6,000	2,070	0.18	2.02
4080-03-24	**8**	R0.3	7,000	8,550	0.03	1.20	6,000	5,850	0.04	1.04	4,000	2,070	0.03	1.04
4080-05-24		R0.5	7,000	8,550	0.04	1.50	6,000	5,850	0.05	1.30	4,000	2,070	0.04	1.30
4080-10-24		R1	7,000	8,550	0.05	1.92	6,000	5,850	0.06	1.80	4,000	2,070	0.05	1.80
4080-20-24		R2	7,000	8,550	0.21	2.88	6,000	5,850	0.23	2.52	4,000	2,070	0.18	2.52
4080-30-24		R3	7,000	8,550	0.21	3.09	6,000	5,850	0.23	2.70	4,000	2,070	0.18	2.70
4100-03-30	**10**	R0.3	6,000	8,550	0.03	1.60	5,000	5,580	0.04	1.30	3,000	2,160	0.03	1.30
4100-05-30		R0.5	6,000	8,550	0.04	2.00	5,000	5,580	0.05	1.62	3,000	2,160	0.04	1.62
4100-10-30		R1	6,000	8,550	0.06	2.57	5,000	5,580	0.07	2.25	3,000	2,160	0.05	2.25
4100-20-30		R2	6,000	8,550	0.24	3.60	5,000	5,580	0.27	3.15	3,000	2,160	0.18	3.15
4100-30-30		R3	6,000	8,550	0.24	3.86	5,000	5,580	0.27	3.38	3,000	2,160	0.18	3.38
4120-03-36	**12**	R0.3	5,000	8,550	0.04	1.93	4,000	7,290	0.04	1.56	2,000	2,250	0.03	1.56
4120-05-36		R0.5	5,000	8,550	0.05	2.41	4,000	7,290	0.05	1.94	2,000	2,250	0.04	1.94
4120-10-36		R1	5,000	8,550	0.07	3.09	4,000	7,290	0.07	2.70	2,000	2,250	0.05	2.70
4120-20-36		R2	5,000	8,550	0.27	4.32	4,000	7,290	0.27	3.78	2,000	2,250	0.18	3.78
4120-40-36		R4	5,000	8,550	0.27	4.63	4,000	7,290	0.27	4.05	2,000	2,250	0.18	4.05

When using an effective length of 5D, or the protruding tool experiences an "overhang", then pay attention to the tool overhang coefficient below while referring to the milling parameter table.
*Effective Length 5D: Effective Length (ℓ_1) ÷ Diameter (ØD) = 5

D:Ø2.0～3.0

Overhang Length L/D	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Axial Depth (mm)	Radial Depth (mm)
～ØD×6	×1	×1	×1	×1
～ØD×7	×0.8	×0.8	×0.8	×0.9
～ØD×8	×0.7	×0.7	×0.7	×0.9
～ØD×9	×0.7	×0.7	×0.6	×0.8
～ØD×10	×0.6	×0.6	×0.6	×0.7

D:Ø4.0～6.0

Overhang Length L/D	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Axial Depth (mm)	Radial Depth (mm)
～ØD×4	×1	×1	×1	×1
～ØD×5	×0.9	×0.9	×0.9	×0.9
～ØD×6	×0.8	×0.8	×0.8	×0.9
～ØD×7	×0.7	×0.7	×0.6	×0.8
～ØD×8	×0.5	×0.5	×0.6	×0.7

D:Ø8.0～12.0

Overhang Length L/D	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Axial Depth (mm)	Radial Depth (mm)
～ØD×4	×1	×1	×1	×1
～ØD×5	×0.7	×0.7	×0.7	×0.8
～ØD×6	×0.5	×0.5	×0.6	×0.7

D:Outside Diameter (mm) L:Overhang Length (mm)

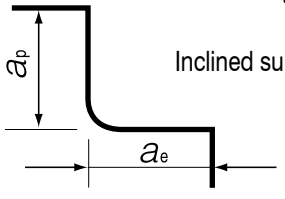
Milling Conditions for HRRS / HRRS-S

◆Finishing（flat / inclined surface） Effective length 3D

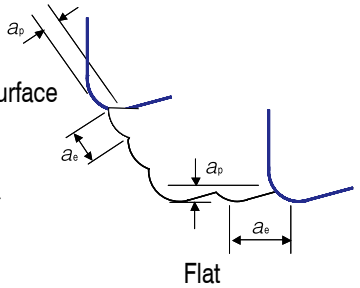
WORK MATERIAL			PREHARDENED STEELS / HARDENED STEELS (30~45HRC) (Air Blow/Oil Mist)				HARDENED STEELS (45~55HRC) (Air Blow/Oil Mist)				HARDENED STEELS (55~65HRC) (Air Blow/Oil Mist)			
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4020-03-06	**2**	R0.3	30,000	850	0.10	0.03	10,000	355	0.10	0.04	8,000	240	0.05	0.03
4020-05-06		R0.5	30,000	1,100	0.10	0.04	10,000	460	0.10	0.05	8,000	310	0.05	0.04
4030-08-09	**3**	R0.8	25,000	1,100	0.10	0.04	10,000	650	0.10	0.07	7,000	350	0.05	0.05
4040-03-12-6	**4**	R0.3	15,000	620	0.08	0.04	9,000	365	0.08	0.04	6,000	205	0.04	0.03
4040-05-12		R0.5	15,000	775	0.10	0.05	9,000	455	0.10	0.05	6,000	255	0.05	0.04
4040-10-12		R1	15,000	1,100	0.10	0.07	9,000	650	0.10	0.07	6,000	360	0.05	0.06
4050-12-15	**5**	R1.2	10,000	1,100	0.10	0.11	8,000	650	0.10	0.08	6,000	360	0.05	0.06
4060-03-18	**6**	R0.3	9,000	550	0.16	0.06	8,000	300	0.16	0.04	6,000	170	0.08	0.03
4060-05-18		R0.5	9,000	690	0.20	0.08	8,000	375	0.20	0.05	6,000	215	0.10	0.04
4060-10-18		R1	9,000	975	0.20	0.11	8,000	530	0.20	0.07	6,000	310	0.10	0.05
4060-15-18		R1.5	9,000	1,200	0.20	0.13	8,000	650	0.20	0.08	6,000	380	0.10	0.06
4060-20-18		R2	9,000	1,385	0.20	0.15	8,000	750	0.20	0.09	6,000	435	0.10	0.07
4080-03-24	**8**	R0.3	7,000	480	0.04	0.07	6,000	260	0.04	0.05	4,000	145	0.04	0.05
4080-05-24		R0.5	7,000	598	0.05	0.09	6,000	322	0.05	0.06	4,000	184	0.05	0.06
4080-10-24		R1	7,000	845	0.05	0.12	6,000	455	0.05	0.08	4,000	265	0.05	0.07
4080-20-24		R2	7,000	1,200	0.20	0.17	6,000	650	0.20	0.11	4,000	380	0.10	0.10
4080-30-24		R3	7,000	1,465	0.20	0.21	6,000	795	0.20	0.13	4,000	465	0.10	0.12
4100-03-30	**10**	R0.3	6,000	478	0.04	0.08	5,000	258	0.04	0.05	3,000	147	0.04	0.06
4100-05-30		R0.5	6,000	598	0.05	0.10	5,000	322	0.05	0.06	3,000	184	0.05	0.07
4100-10-30		R1	6,000	845	0.05	0.14	5,000	455	0.05	0.09	3,000	265	0.05	0.09
4100-20-30		R2	6,000	1,200	0.20	0.20	5,000	650	0.20	0.13	3,000	380	0.10	0.13
4100-30-30		R3	6,000	1,470	0.20	0.25	5,000	795	0.20	0.16	3,000	465	0.10	0.16
4120-03-36	**12**	R0.3	5,000	480	0.04	0.10	4,000	260	0.04	0.07	2,000	145	0.04	0.09
4120-05-36		R0.5	5,000	598	0.05	0.12	4,000	322	0.05	0.08	2,000	184	0.05	0.10
4120-10-36		R1	5,000	845	0.05	0.17	4,000	455	0.05	0.11	2,000	265	0.05	0.13
4120-20-36		R2	5,000	1,200	0.20	0.24	4,000	650	0.20	0.16	2,000	380	0.10	0.19
4120-40-36		R4	5,000	1,695	0.20	0.34	4,000	915	0.20	0.23	2,000	535	0.10	0.27

When using an effective length of 5D, or the protruding tool experiences an "overhang", then pay attention to the tool overhang coefficient found on page 326 while referring to the milling parameter table.
*Effective Length 5D: Effective Length (ℓ_1) ÷ Diameter (ØD) = 5

Roughing Parameter



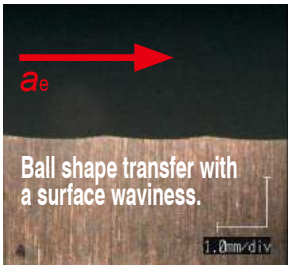
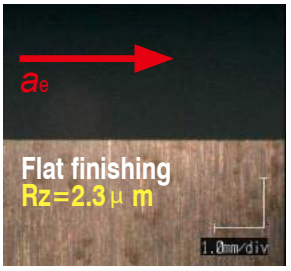
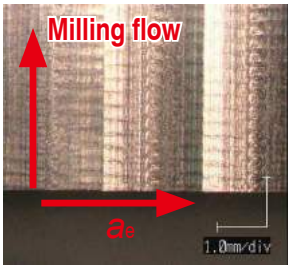
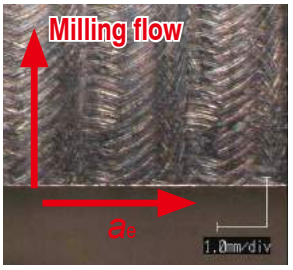
Finishing Parameter
（Flat / Inclined surface）

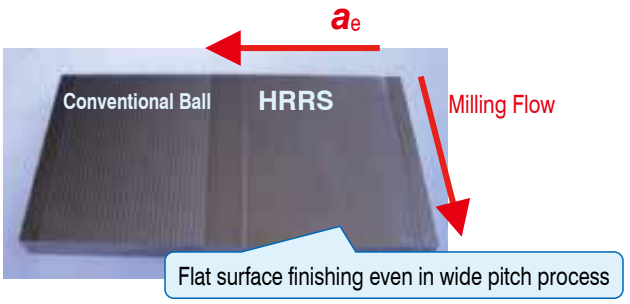


a_p : Axial Depth（mm）
a_e : Radial Depth（mm）

Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Decrease the feed rate more than 50% from the milling parameters when slot milling.
・Only adjust the spindle speed when calculate milling conditions based on the overhang length in finishing process.
・Recommend air blow or oil mist.

Flat Milling Example: Milling with HRRSØ12 x CR4 SKD11 (60HRC)

	Conventional Ball R6	HRRS 4120-40-36
Side		
Top		



HRRS Surface Roughness
Maximum Surface Roughness (calculated value) = 2.375 μm

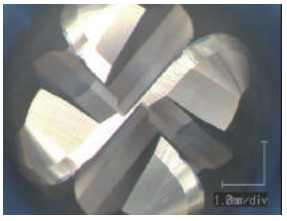
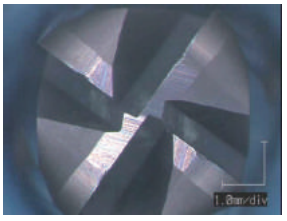
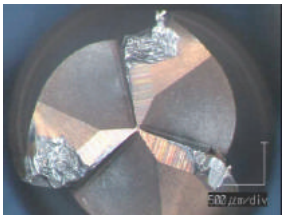
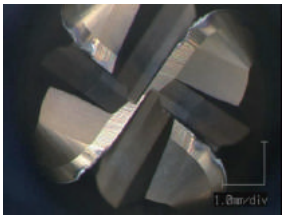
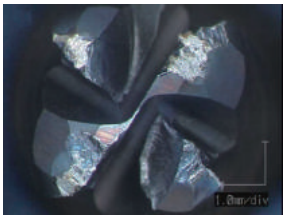
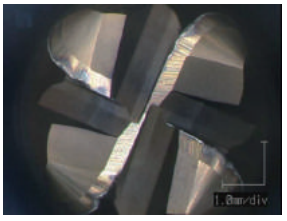
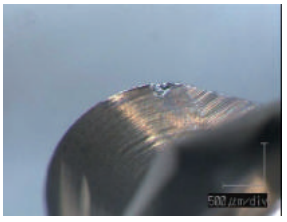
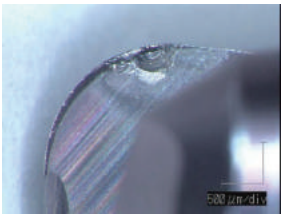
Spindle Speed	Feed Rate	a_p Axial Depth	a_e Radial Depth	Milling Distance	Radial Depth
2,000 min^{-1}	535 mm/min	0.1 mm	2 mm	100 mm × 35 Times	55 mm

HRRS Series NAK80 (40HRC) Milling Video

HRRS Series DH31S (52HRC) Milling Video

HRRS Series DH31 (52HRC) Milling Video

Pocket Milling Example: Milling with HRRS Ø6 × CR1.5 SKD11 (60HRC)

	HRRS	Competitor A: 4 Flutes	Competitor B: 4 Flutes	Competitor B: 3 Flutes
Depth 0.9 mm				
Depth 12.3 mm				Broken
Depth 16.5 mm	 	 	Broken  Pocket Milling Cycle Time: 40 min	

Spindle Speed	Z helical Approach	Feed Rate	a_p Axial Depth	a_e Radial Depth	Overhang Length	Cycle Time	Coolant
2,700 min^{-1}	1,350 mm/min	2,000 mm/min	0.3 mm (0.05D)	1.5 mm (0.25D)	20 mm	40 min	Air Blow (Nozzle)

Longer tool life on 60HRC milling.

4 Flutes HARDMAX

Size **Ø2~Ø12**

Short Shank Series

HRRS-S

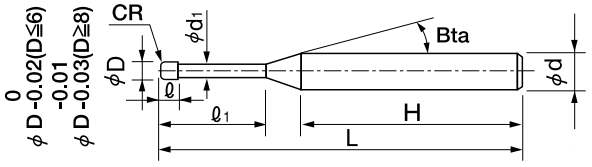
Super MG | HARD MAX | 45° | R | R ±0.01 (Ø2~Ø6) | R ±0.015 (Ø8~Ø12) | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
		◎	◎	◎	○ ~65HRC	○									

Features

Shorter overall length and overhang offer higher feed and precision.
Achieves larger step over by seamless corner radius design.
Rated to 65HRC milling.
Refer to page 326, 327 for Milling Conditions.



The shank taper angle and the shank length (H) shown are not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

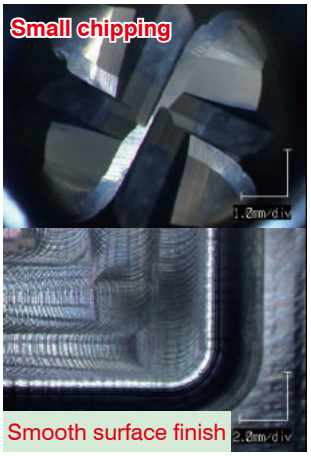
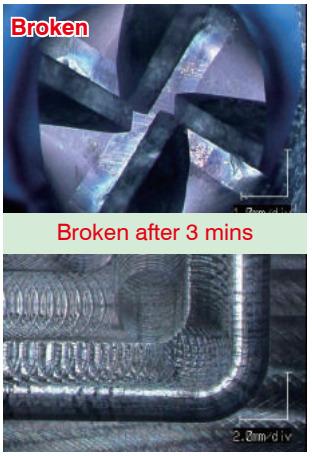
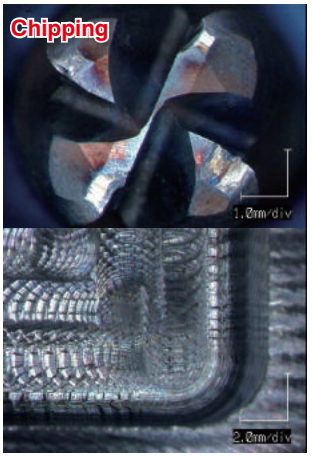
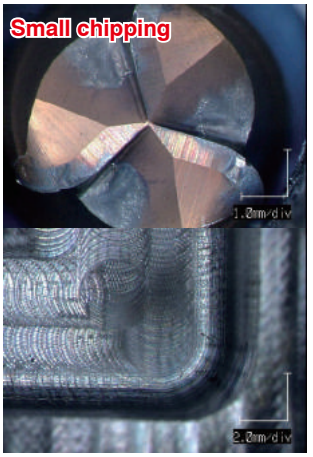
Total 26 models — **Unit (mm)**

	Model Number	Outside Diameter ØD	Corner Radius CR	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Shank Length H
	HRRS 4020-03-06S	2	R0.3	6	2	1.91	16°	45	4	33.0
	HRRS 4020-05-06S		R0.5					45	4	33.0
◎	HRRS 4030-08-09-3S	3	R0.8	9	3	2.92	-	50	3	38.5
	HRRS 4030-08-09S						16°	50	6	32.0
◎	HRRS 4040-05-12S	4	R0.5	12	4	3.82	-	50	4	35.0
	HRRS 4040-05-12-6S						16°	50	6	31.0
◎	HRRS 4040-10-12S		R1				-	50	4	35.0
	HRRS 4040-10-12-6S						16°	50	6	31.0
	HRRS 4050-12-15S	5	R1.2	15	5	4.82	16°	50	6	30.0
◎	HRRS 4060-05-18S	6	R0.5	18	6	5.82	-	50	6	29.0
◎	HRRS 4060-10-18S		R1					50	6	29.0
◎	HRRS 4060-15-18S		R1.5					50	6	29.0
◎	HRRS 4060-20-18S		R2					50	6	29.0
◎	HRRS 4080-05-24S	8	R0.5	24	8	7.82	-	60	8	33.0
◎	HRRS 4080-10-24S		R1					60	8	33.0
◎	HRRS 4080-20-24S		R2					60	8	33.0
◎	HRRS 4080-30-24S		R3					60	8	33.0
◎	HRRS 4100-03-30S	10	R0.3	30	10	9.82	-	65	10	31.5
◎	HRRS 4100-05-30S		R0.5					65	10	31.5
◎	HRRS 4100-10-30S		R1					65	10	31.5
◎	HRRS 4100-20-30S		R2					65	10	31.5
◎	HRRS 4100-30-30S		R3					65	10	31.5
◎	HRRS 4120-05-36S	12	R0.5	36	12	11.82	-	75	12	35.5
◎	HRRS 4120-10-36S		R1					75	12	35.5
◎	HRRS 4120-20-36S		R2					75	12	35.5
◎	HRRS 4120-40-36S		R4					75	12	35.5

◎Straight shank type

Pocket Milling Example: Milling with HRRS Ø6 × CR1.5

NAK80（40HRC）

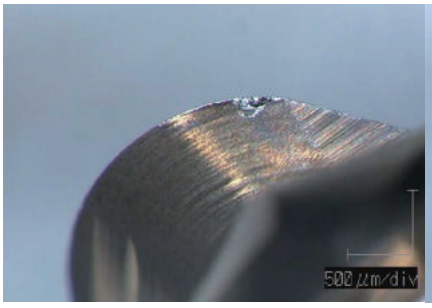
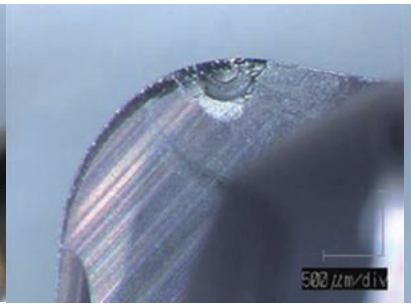
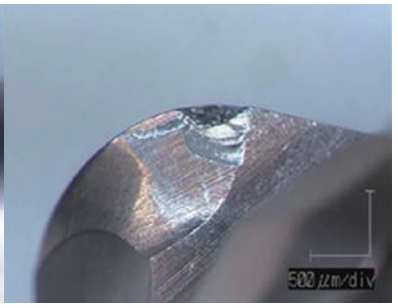
HRRS	Competitor A: 4 Flutes	Competitor B: 4 Flutes	Competitor B: 3 Flutes
			
CR1.5, FL6 mm, EFL18 mm	CR1.5, FL6 mm, EFL18 mm	CR1.5, FL12 mm	CR1.5, FL12 mm

Spindle Speed	Feed Rate	Axial Depth	Radial Depth	Overhang Length	Cycle Time	Pocket Size
9,000 min^{-1}	11,000 mm/min	0.3 mm（0.05D）	3 mm（0.5D）	20 mm	20 min	40 × 180 × depth 15 mm

Excellent chipping resistance and surface quality !

Original Corner Radius Design offers High Rigidity and reduces Cutting Force

After milling SKD11 (60HRC)

HRRS	Competitor	Competitor
		
Seamless corner radius with equal rake angle design. Reduces the cutting force and offers excellent chip evacuation to protect from the tool damage.	Flat and non-helix gash design. Badly damaged at tip point where cutting chips are trapped by poor chip evacuation.	Flat and helical gash design. Huge tool damage at tangent point where the gash shape abruptly changed and cutting chips could not evacuate properly.

Spindle Speed	Feed Rate	Axial Depth	Radial Depth	Overhang Length	Pocket Size
2,700 min^{-1}	2,000 mm/min	0.3 mm	1.5 mm	20 mm	40 × 40 × 0.3 mm

Longer Tool Life with Variable Pitch Design. Recommended for Various Coolant.

4 Flutes HARDMAX

Size Ø1~Ø6

HTNRS

Super MG | HARD MAX | 45° | R | R ±0.01 | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

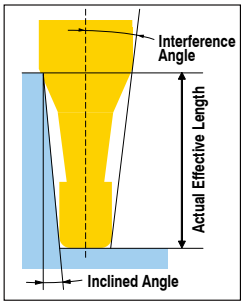
Additional 31 models

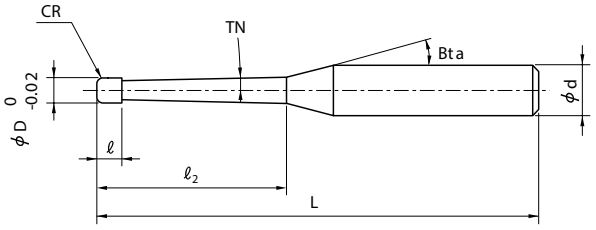
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
		◎	◎	◎	○ ~65HRC	○									

Features

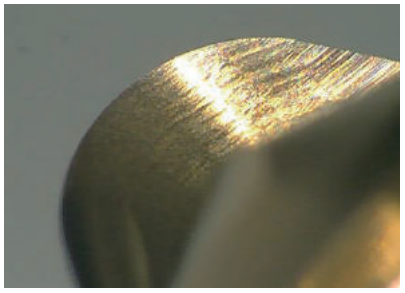
4 flute taper neck radius end mills for milling hard materials.
Corner radius design from the edge to the periphery ensures less cutting resistance, and the variable pitch design minimizes chattering and vibration.
Stable milling and excellent surface finish on deep milling.
HARDMAX coating offers longer tool life when milling hard materials.
Any type of coolant is available.



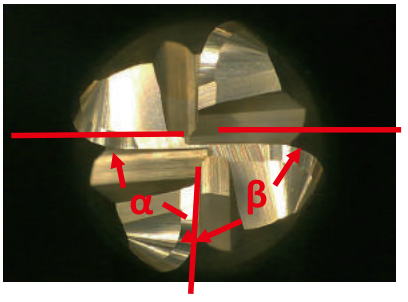


The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Feature ①
Seamless Corner Radius
High rigidity! Less cutting resistance!



Feature ②
Variable Pitch design
Minimizing vibration and chattering !



※ **Variable Pitch** : α≠β

Feature ③
A wide choice of Taper Neck Angles available
More efficient with 0.4° !

Total 75 models

Unit (mm)

	Model Number	Outside Diameter ØD	Corner Radius CR	Neck Taper Angle TN	Neck Length ℓ2	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Interference Angle	Effective Length by Inclined Angles - : Interference				
											30'	1°	1°30'	2°	3°
	HTNRS 4010-020618	1	R0.2	0.9°	6	1	16°	50	4	7.49°	-	6.61	6.96	7.23	7.76
	HTNRS 4010-021018				10			50	4	5.65°	-	10.66	11.15	11.53	12.38
※	HTNRS 4010-021518				15			50	4	4.33°	-	15.72	16.35	16.92	18.17
	HTNRS 4010-022018				20			60	4	3.50°	-	20.77	21.56	22.30	23.95
※	HTNRS 4010-022518				25			60	4	2.94°	-	25.82	26.76	27.68	No Interference
	HTNRS 4010-023018				30			70	4	2.54°	-	30.87	31.96	33.06	No Interference
※	HTNRS 4010-023518				35			80	4	2.23°	-	35.92	37.16	38.44	No Interference
	HTNRS 4010-024018				40			80	4	1.99°	-	40.96	42.36	No Interference	No Interference
	HTNRS 4010-025018				50			90	4	1.64°	-	51.02	52.74	No Interference	No Interference
	HTNRS 40125-020618	1.25	R0.2	0.9°	6	1.25	16°	50	4	7.14°	-	6.63	6.97	7.24	7.77
	HTNRS 40125-021018				10			50	4	5.34°	-	10.68	11.16	11.55	12.40
※	HTNRS 40125-021518				15			50	4	4.05°	-	15.74	16.37	16.93	18.18
	HTNRS 40125-022018				20			60	4	3.27°	-	20.79	21.57	22.31	23.96
	HTNRS 40125-023018				30			70	4	2.36°	-	30.89	31.97	33.07	No Interference
	HTNRS 40125-024018				40			80	4	1.84°	-	40.97	42.37	No Interference	No Interference
	HTNRS 40125-025018				50			90	4	1.51°	-	51.03	52.75	No Interference	No Interference
	HTNRS 4015-030618	1.5	R0.3	0.9°	6	1.5	16°	50	4	6.80°	-	6.69	7.01	7.27	7.79
	HTNRS 4015-031018				10			50	4	5.03°	-	10.73	11.19	11.57	12.42
※	HTNRS 4015-031518				15			50	4	3.79°	-	15.79	16.39	16.95	18.20
	HTNRS 4015-032018				20			60	4	3.04°	-	20.84	21.60	22.34	23.99
※	HTNRS 4015-032518				25			60	4	2.54°	-	25.88	26.80	27.72	No Interference
	HTNRS 4015-033018				30			70	4	2.18°	-	30.93	32.00	33.10	No Interference
	HTNRS 4015-034018				40			80	4	1.70°	-	41.01	42.40	No Interference	No Interference
	HTNRS 4015-035018				50			90	4	1.39°	-	51.07	No Interference	No Interference	No Interference
	HTNRS 40175-030618	1.75	R0.3	0.9°	6	1.75	16°	50	4	6.37°	-	6.75	7.06	7.31	7.84
	HTNRS 40175-031018				10			50	4	4.66°	-	10.79	11.23	11.61	12.46
※	HTNRS 40175-031518				15			60	4	3.49°	-	15.84	16.43	16.99	18.24
	HTNRS 40175-032018				20			60	4	2.78°	-	20.89	21.63	22.38	No Interference
	HTNRS 40175-033018				30			70	4	1.99°	-	30.98	32.04	No Interference	No Interference
	HTNRS 40175-034018				40			80	4	1.54°	-	41.06	42.44	No Interference	No Interference
	HTNRS 40175-035018				50			90	4	1.26°	-	51.11	No Interference	No Interference	No Interference
※	HTNRS 4020-052008	2	R0.5	0.4°	20	2	16°	60	4	2.48°	20.86	21.60	22.30	23.06	No Interference
※	HTNRS 4020-052608				26			60	4	1.98°	26.92	27.83	28.75	No Interference	No Interference
※	HTNRS 4020-053008				30			70	4	1.75°	30.95	31.98	33.04	No Interference	No Interference
※	HTNRS 4020-053608				36			80	4	1.49°	37.00	38.22	No Interference	No Interference	No Interference
※	HTNRS 4020-054008				40			80	4	1.35°	41.03	42.37	No Interference	No Interference	No Interference
	HTNRS 4020-051018			0.9°	10			60	4	4.33°	-	10.84	11.25	11.63	12.46
※	HTNRS 4020-051518				15			60	4	3.21°	-	15.88	16.45	17.01	18.25
	HTNRS 4020-052018				20			60	4	2.54°	-	20.93	21.66	22.39	No Interference
※	HTNRS 4020-052518				25			60	4	2.11°	-	25.97	26.86	27.77	No Interference
	HTNRS 4020-053018				30			70	4	1.80°	-	31.01	32.06	No Interference	No Interference
※	HTNRS 4020-053518				35			80	4	1.57°	-	36.05	37.26	No Interference	No Interference
	HTNRS 4020-054018				40			80	4	1.39°	-	41.09	No Interference	No Interference	No Interference
※	HTNRS 4020-054518				45			90	4	1.25°	-	46.10	No Interference	No Interference	No Interference
	HTNRS 4020-055018				50			90	4	1.14°		51.14	No Interference	No Interference	No Interference

※Additional model

Next Page ➡

4 Flutes HARDMAX

Unit (mm)

	Model Number	Outside Diameter ØD	Corner Radius CR	Neck Taper Angle TN	Neck Length ℓ2	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Interference Angle	Effective Length by Inclined Angles - : Interference				
											30'	1°	1°30'	2°	3°
※	HTNRS 4030-082008	3	R0.8	0.4°	20	3	16°	60	6	3.48°	20.88	21.60	22.30	23.05	24.72
※	HTNRS 4030-082608				26			60	6	2.82°	26.94	27.84	28.74	29.72	No Interference
※	HTNRS 4030-083008				30			70	6	2.51°	30.97	31.99	33.04	34.16	No Interference
※	HTNRS 4030-083608				36			80	6	2.14°	37.02	38.22	39.48	40.82	No Interference
※	HTNRS 4030-084008				40			80	6	1.96°	41.05	42.38	43.78	No Interference	No Interference
	HTNRS 4030-082018			0.9°	20			60	6	3.56°	-	20.98	21.69	22.41	24.03
※	HTNRS 4030-082518				25			60	6	2.99°	-	26.02	26.89	27.79	No Interference
	HTNRS 4030-083018				30			70	6	2.57°	-	31.06	32.09	33.18	No Interference
※	HTNRS 4030-083518				35			80	6	2.25°	-	36.10	37.29	38.56	No Interference
	HTNRS 4030-084018				40			80	6	2.01°	-	41.13	42.49	43.94	No Interference
	HTNRS 4030-085018				50			90	6	1.65°	-	51.18	52.87	No Interference	No Interference
	HTNRS 4030-086018				60			100	6	1.40°	-	61.25	No Interference	No Interference	No Interference
※	HTNRS 4040-102508	4	R1	0.4°	25	4	16°	60	6	2.12°	25.49	26.28	27.13	28.04	No Interference
※	HTNRS 4040-103008				30			70	6	1.80°	30.52	31.48	32.50	No Interference	No Interference
※	HTNRS 4040-103508				35			80	6	1.57°	35.55	36.67	37.87	No Interference	No Interference
※	HTNRS 4040-104008				40			80	6	1.39°	40.58	41.87	No Interference	No Interference	No Interference
※	HTNRS 4040-104508				45			90	6	1.24°	45.61	47.06	No Interference	No Interference	No Interference
※	HTNRS 4040-105008				50			90	6	1.13°	50.63	52.24	No Interference	No Interference	No Interference
	HTNRS 4040-102018			0.9°	20			60	6	2.64°	-	20.57	21.23	21.93	No Interference
※	HTNRS 4040-102518				25			60	6	2.18°	-	25.60	26.43	27.32	No Interference
	HTNRS 4040-103018				30			70	6	1.85°	-	30.64	31.63	No Interference	No Interference
※	HTNRS 4040-103518				35			80	6	1.61°	-	35.67	36.83	No Interference	No Interference
	HTNRS 4040-104018				40			80	6	1.42°	-	40.70	No Interference	No Interference	No Interference
	HTNRS 4040-105018				50			90	6	1.16°	-	50.75	No Interference	No Interference	No Interference
	HTNRS 4040-106018				60			100	6	0.98°	-	No Interference	No Interference	No Interference	No Interference
	HTNRS 4060-152018	6	R1.5	0.9°	20	6	16°	60	8	2.69°	-	20.63	21.28	21.97	No Interference
	HTNRS 4060-153018				30			70	8	1.88°	-	30.70	31.68	No Interference	No Interference
	HTNRS 4060-154018				40			80	8	1.44°	-	40.76	No Interference	No Interference	No Interference
	HTNRS 4060-155018				50			90	8	1.17°	-	50.83	No Interference	No Interference	No Interference
	HTNRS 4060-156018				60			100	8	0.98°	-	No Interference	No Interference	No Interference	No Interference

※Additional model

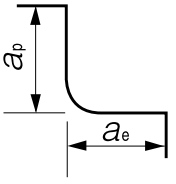
Milling Conditions for HTNRS

WORK MATERIAL					PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30～45HRC)				HARDENED STEELS SKD / SKT (45～55HRC)				HARDENED STEELS SKD / SKH (55～65HRC)			
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Neck Taper Angle TN	Neck Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4010-020618				6	20,000	2,600	0.06	0.45	11,600	980	0.029	0.24	8,900	530	0.012	0.1
4010-021018				10	19,000	2,450	0.03	0.43	11,000	920	0.015	0.22	8,500	480	0.008	0.075
4010-021518				15	18,500	2,400	0.02	0.41	10,700	880	0.01	0.21	8,200	450	0.006	0.065
4010-022018				20	18,000	2,300	0.01	0.4	10,400	850	0.006	0.2	8,000	430	0.005	0.05
4010-022518	**1**	R0.2	0.9°	25	17,000	2,150	0.008	0.38	9,900	800	0.005	0.19	7,700	410	0.004	0.05
4010-023018				30	16,000	2,000	0.007	0.35	9,400	750	0.004	0.18	7,400	390	0.004	0.05
4010-023518				35	15,000	1,850	0.006	0.32	8,800	700	0.004	0.16	7,000	370	0.003	0.05
4010-024018				40	14,000	1,750	0.005	0.3	8,300	660	0.003	0.15	6,700	350	0.003	0.05
4010-025018				50	12,000	1,500	0.003	0.28	7,200	570	0.002	0.14	6,000	310	0.002	0.05
40125-020618				6	16,000	2,600	0.075	0.56	9,200	990	0.036	0.3	7,100	540	0.015	0.12
40125-021018				10	16,000	2,600	0.057	0.55	9,200	990	0.027	0.29	7,100	540	0.012	0.1
40125-021518				15	15,500	2,500	0.04	0.53	8,900	950	0.019	0.27	6,900	500	0.01	0.08
40125-022018	**1.25**	R0.2	0.9°	20	15,000	2,400	0.022	0.51	8,700	900	0.011	0.26	6,700	470	0.007	0.07
40125-023018				30	14,400	2,300	0.011	0.47	8,300	860	0.006	0.23	6,400	440	0.005	0.06
40125-024018				40	12,800	2,000	0.008	0.42	7,500	750	0.004	0.21	5,900	390	0.004	0.06
40125-025018				50	11,000	1,700	0.006	0.37	6,500	650	0.003	0.19	5,300	350	0.003	0.06
4015-030618				6	13,500	2,600	0.09	0.67	7,800	990	0.043	0.36	6,000	540	0.018	0.15
4015-031018				10	13,500	2,600	0.083	0.67	7,800	990	0.04	0.36	6,000	540	0.017	0.14
4015-031518				15	13,000	2,500	0.055	0.65	7,500	950	0.029	0.34	5,800	500	0.013	0.12
4015-032018				20	12,500	2,400	0.035	0.63	7,200	900	0.018	0.32	5,600	470	0.01	0.1
4015-032518	**1.5**	R0.3	0.9°	25	12,500	2,400	0.025	0.61	7,000	880	0.013	0.31	5,500	460	0.009	0.08
4015-033018				30	12,000	2,300	0.015	0.6	6,900	860	0.008	0.3	5,350	440	0.007	0.07
4015-034018				40	12,000	2,300	0.012	0.55	6,900	860	0.007	0.27	5,350	440	0.006	0.07
4015-035018				50	10,500	2,000	0.009	0.5	6,100	740	0.005	0.25	4,850	380	0.005	0.07
40175-030618				6	11,500	2,600	0.105	0.78	6,600	990	0.05	0.42	5,100	540	0.021	0.17
40175-031018				10	11,500	2,600	0.105	0.78	6,600	990	0.05	0.42	5,100	540	0.021	0.17
40175-031518				15	11,500	2,600	0.07	0.76	6,500	950	0.037	0.4	5,000	510	0.017	0.14
40175-032018	**1.75**	R0.3	0.9°	20	11,000	2,450	0.047	0.74	6,400	920	0.024	0.38	4,900	480	0.013	0.12
40175-033018				30	11,000	2,450	0.027	0.71	6,400	920	0.014	0.36	4,900	480	0.01	0.1
40175-034018				40	10,000	2,200	0.016	0.67	5,800	820	0.009	0.33	4,450	420	0.008	0.08
40175-035018				50	10,000	2,200	0.013	0.62	5,800	820	0.008	0.31	4,450	420	0.007	0.08
4020-052008				20	9,500	2,450	0.06	0.85	5,500	920	0.025	0.43	4,250	480	0.015	0.13
4020-052608				26	9,500	2,450	0.04	0.83	5,500	920	0.021	0.42	4,250	480	0.013	0.12
4020-053008			0.4°	30	9,000	2,300	0.03	0.79	5,400	880	0.016	0.41	4,100	450	0.012	0.11
4020-053608				36	9,000	2,300	0.02	0.75	5,200	850	0.011	0.39	4,000	430	0.01	0.1
4020-054008				40	9,000	2,300	0.02	0.7	5,200	850	0.01	0.38	4,000	430	0.009	0.1
4020-051018				10	10,000	2,600	0.12	0.9	5,800	990	0.057	0.49	4,450	540	0.024	0.2
4020-051518				15	10,000	2,600	0.09	0.88	5,600	950	0.044	0.47	4,350	510	0.02	0.17
4020-052018	**2**	R0.5		20	9,500	2,450	0.06	0.86	5,500	920	0.03	0.45	4,250	480	0.016	0.15
4020-052518				25	9,500	2,450	0.05	0.85	5,500	920	0.025	0.43	4,250	480	0.015	0.13
4020-053018			0.9°	30	9,500	2,450	0.04	0.83	5,500	920	0.021	0.42	4,250	480	0.013	0.12
4020-053518				35	9,000	2,300	0.03	0.81	5,300	880	0.016	0.41	4,100	450	0.012	0.11
4020-054018				40	9,000	2,300	0.02	0.8	5,200	850	0.012	0.4	4,000	430	0.01	0.1
4020-054518				45	9,000	2,300	0.02	0.75	5,200	850	0.011	0.39	4,000	430	0.01	0.1
4020-055018				50	9,000	2,300	0.017	0.75	5,200	850	0.01	0.38	4,000	430	0.009	0.1

Milling Conditions for HTNRS

WORK MATERIAL					PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30~45HRC)				HARDENED STEELS SKD / SKT (45~55HRC)				HARDENED STEELS SKD / SKH (55~65HRC)			
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Neck Taper Angle TN	Neck Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4030-082008	**3**	R0.8	0.4°	20	6,500	2,500	0.12	1.06	3,900	960	0.05	0.58	3,200	550	0.029	0.25
4030-082608				26	6,300	2,400	0.08	1.04	3,800	940	0.038	0.56	3,100	520	0.025	0.22
4030-083008				30	6,300	2,400	0.064	1.01	3,800	920	0.034	0.55	3,100	510	0.022	0.21
4030-083608				36	6,300	2,400	0.05	1	3,800	920	0.028	0.52	3,100	510	0.02	0.19
4030-084008				40	6,300	2,400	0.04	0.98	3,800	920	0.023	0.51	3,100	510	0.018	0.17
4030-082018			0.9°	20	6,700	2,600	0.13	1.07	4,000	1,000	0.065	0.6	3,300	590	0.034	0.28
4030-082518				25	6,500	2,500	0.1	1.05	3,900	960	0.05	0.58	3,200	550	0.029	0.25
4030-083018				30	6,300	2,400	0.072	1.03	3,800	920	0.038	0.56	3,100	510	0.024	0.22
4030-083518				35	6,300	2,400	0.064	1.01	3,800	920	0.034	0.55	3,100	510	0.022	0.21
4030-084018				40	6,300	2,400	0.056	1	3,800	920	0.03	0.54	3,100	510	0.021	0.2
4030-085018				50	6,300	2,400	0.04	0.98	3,800	920	0.023	0.51	3,100	510	0.018	0.17
4030-086018				60	6,000	2,300	0.024	0.96	3,600	870	0.015	0.49	2,900	470	0.015	0.15
4040-102508	**4**	R1	0.4°	25	5,000	2,600	0.17	1.42	3,000	1,000	0.085	0.8	2,450	600	0.045	0.38
4040-103008				30	5,000	2,600	0.13	1.39	2,900	960	0.065	0.77	2,400	540	0.038	0.34
4040-103508				35	4,800	2,450	0.09	1.37	2,900	920	0.048	0.75	2,350	480	0.032	0.3
4040-104008				40	4,800	2,450	0.08	1.35	2,900	920	0.043	0.74	2,350	480	0.03	0.28
4040-104508				45	4,800	2,450	0.07	1.33	2,900	920	0.038	0.72	2,350	480	0.028	0.26
4040-105008				50	4,800	2,450	0.06	1.32	2,900	920	0.034	0.7	2,350	480	0.026	0.25
4040-102018			0.9°	20	5,000	2,600	0.19	1.44	3,000	1,000	0.095	0.82	2,450	600	0.048	0.4
4040-102518				25	5,000	2,600	0.17	1.42	3,000	1,000	0.085	0.8	2,450	600	0.045	0.38
4040-103018				30	5,000	2,600	0.15	1.41	3,000	1,000	0.076	0.79	2,450	600	0.042	0.36
4040-103518				35	4,800	2,450	0.12	1.39	2,900	960	0.062	0.77	2,400	540	0.037	0.33
4040-104018				40	4,800	2,450	0.09	1.37	2,900	920	0.048	0.75	2,350	480	0.032	0.3
4040-105018				50	4,800	2,450	0.08	1.35	2,900	920	0.043	0.72	2,350	480	0.029	0.27
4040-106018				60	4,800	2,450	0.06	1.32	2,900	920	0.034	0.7	2,350	480	0.026	0.25
4060-152018	**6**	R1.5	0.9°	20	3,350	2,600	0.28	2.16	2,000	1,000	0.14	1.24	1,650	600	0.072	0.6
4060-153018				30	3,350	2,600	0.28	2.16	2,000	1,000	0.14	1.24	1,650	600	0.072	0.6
4060-154018				40	3,350	2,600	0.26	2.14	2,000	1,000	0.131	1.21	1,650	600	0.068	0.57
4060-155018				50	3,350	2,600	0.2	2.1	2,000	1,000	0.103	1.17	1,650	600	0.058	0.51
4060-156018				60	3,150	2,400	0.14	2.06	1,900	920	0.075	1.12	1,550	510	0.048	0.45

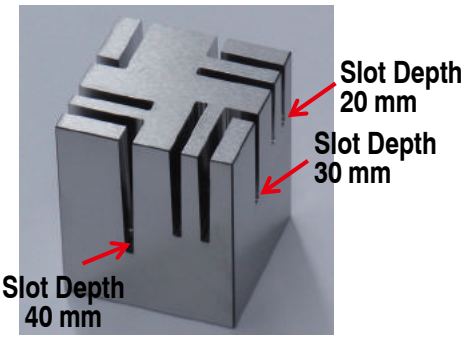
Side Milling
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)



Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Every coolant offers stable milling.

Milling example of taper slotting
HTNRS　Ø2 × CR0.5 × Neck Length 20 mm

SKD61（45HRC）



- Work Size　：50 × 50 × 60 mm
- Inclined Angle：1°
- Slot Length　：27 mm（L Shape Slot）
  21 mm（Straight Slot）
- Slot Width　：2.6 mm（Bottom）
- Slot Depth　：20, 30, 40 mm
- Coolant　：Water Soluble

① Performance compared with straight neck type…Depth 20 mm L shape slotting

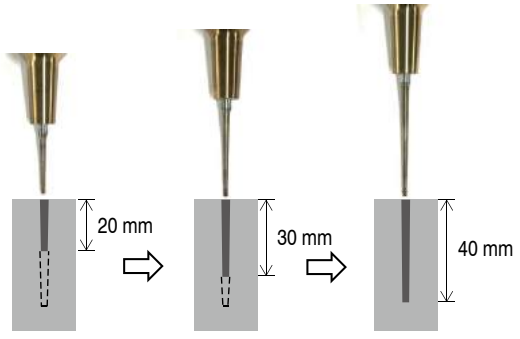
Milling Process	Tool	Neck Shape Helix Angle	Tool Size (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Cycle Time
Roughing	HTNRS 4020-052018	Taper Neck 0.9° 45° Helix Angle	Ø2 × CR0.5 × Neck Length 20	9,500	2,450	0.064	20 min 18 sec
Roughing	HLRS 4020-05-200	Straight Neck 30° Helix Angle	Ø2 × CR0.5 × Effective Length 20	7,000	800	0.025	1 h 30 min 9 sec

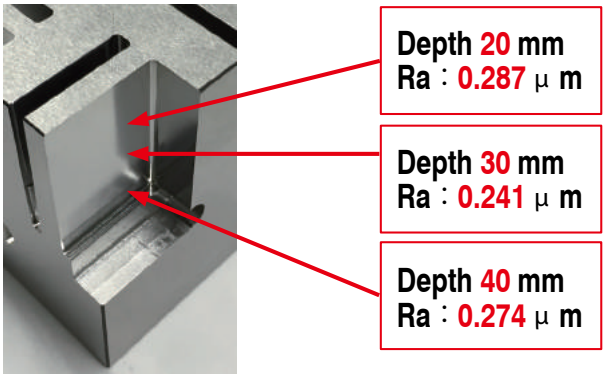
Taper neck 7 times more efficient in 20 mm depth slotting !

② 40 mm Depth L shape slotting

Milling Process	Tool	Neck Shape Helix Angle	Tool Size (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	Cycle Time
Roughing	HTNRS 4020-052018	Taper Neck 0.9° 45° Helix Angle	Ø2 × CR0.5 × Neck Length 20 mm	9,500	2,450	0.064	27 min 8 sec
Roughing	HTNRS 4020-053018		Ø2 × CR0.5 × Neck Length 30 mm	9,500	2,450	0.047	15 min 32 sec
Roughing	HTNRS 4020-054018		Ø2 × CR0.5 × Neck Length 40 mm	9,000	2,300	0.02	40 min 26 sec
Finishing				4,500	500	0.0001 (Cusp Height)	4 h 28 min 50 sec

Slotting image of 40 mm depth





40 mm slot depth roughing process completed in 1h 23 min ! Excellent surface finishing !

Size **R0.3~R6**

CFB

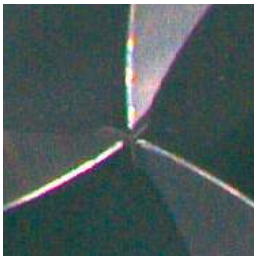
Super MG | UT COAT | 30° | R ±0.005 (R0.3~R1.5) | R ±0.007 (R2~R3) | R ±0.01 (R4~R6) | Shank Dia 0/-0.005 | Variable Pitch

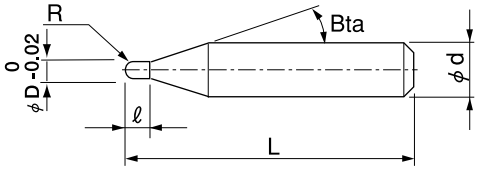
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~ 55HRC	Hardened Steels ~ 60HRC	Hardened Steels ~ 70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	◎			○	◎		◎	○		◎	◎		

Features

3 flute design offers high feed milling, reducing cycle times when roughing.
Capable of deep milling that raises machine efficiency, even with complicated shapes that require slow feeds. Variable pitch design minimizes tool chattering.
Broad range of applications from Copper and Raw Materials to Hardened Steels (55HRC).
The original design features help to promote excellent chip evacuation and surface finishing on tools that are R0.75 mm and larger.
Diameter Tolerance: 0/-0.02





The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 14 models — Unit (mm)

Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
CFB 3006-0090	R0.3	0.9	16°	50	4
CFB 3008-0120	R0.4	1.2	16°	50	4
CFB 3010-0150	R0.5	1.5	16°	50	4
CFB 3015-0225	R0.75	2.25	16°	50	4
CFB 3020-0300	R1	3	16°	50	4
CFB 3030-0450	R1.5	4.5	16°	60	6
CFB 3040-0600-4	R2	6	-	70	4
CFB 3040-0600	R2	6	16°	70	6
CFB 3050-0750	R2.5	7.5	16°	80	6
CFB 3060-0900	R3	9	-	80	6
CFB 3080-1200	R4	12	-	90	8
CFB 3080-1200LS	R4	12	-	120	8
CFB 3100-1500	R5	15	-	100	10
CFB 3120-1800	R6	18	-	110	12

Milling Conditions for CFB

◆Roughing

WORK MATERIAL		Copper / Aluminum Alloys C1100 / A5052 / A7075 (～225HB)				Alloy Steels / Hardened Steels S45C / S50C / SKD / NAK (～45HRC)				Hardened Steels STAVAX / SKD61 (45～55HRC)			
Coolant		DRY (Unsuitable for Aluminum Alloys) / WET				DRY / WET				DRY			
Model Number	Radius of Ball Nose (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
3006-0090	**R0.3**	30,000	1,000	0.03	0.13	30,000	1,000	0.03	0.13	30,000	700	0.03	0.13
3008-0120	**R0.4**	30,000	1,250	0.04	0.17	30,000	1,250	0.04	0.17	30,000	850	0.04	0.17
3010-0150	**R0.5**	30,000	1,500	0.05	0.21	30,000	1,500	0.05	0.21	30,000	1,000	0.05	0.21
3015-0225	**R0.75**	30,000	2,500	0.075	0.32	30,000	2,500	0.075	0.32	30,000	1,700	0.075	0.32
3020-0300	**R1**	30,000	3,200	0.2	0.6	30,000	3,200	0.2	0.6	30,000	2,500	0.2	0.6
3030-0450	**R1.5**	24,000	4,000	0.3	0.9	24,000	4,000	0.3	0.9	21,600	2,700	0.3	0.9
3040-0600	**R2**	18,000	4,000	0.4	1.2	18,000	4,000	0.4	1.2	16,200	2,700	0.4	1.2
3050-0750	**R2.5**	15,000	4,000	0.5	1.5	15,000	4,000	0.5	1.5	13,500	2,700	0.5	1.5
3060-0900	**R3**	12,000	4,000	0.6	1.8	12,000	4,000	0.6	1.8	10,800	2,700	0.6	1.8
3080-1200 (LS)	**R4**	9,000	4,000	0.8	2.4	9,000	4,000	0.8	2.4	8,100	2,700	0.75	2.1
3100-1500	**R5**	7,200	4,000	1	3	7,200	4,000	1	3	6,500	2,700	0.85	2.5
3120-1800	**R6**	6,000	4,000	1.2	3.6	6,000	4,000	1.2	3.6	5,400	2,700	0.95	3

WORK MATERIAL		Titanium Alloys / Stainless Steels Ti-6A l-4V / SUS				Heat Resistant Steels Inconel718			
Coolant		DRY (Unsuitable for Aluminum Alloys) / WET				WET			
Model Number	Radius of Ball Nose (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
3006-0090	**R0.3**	20,000	1,000	0.015	0.09	10,000	250	0.015	0.09
3008-0120	**R0.4**	20,000	1,250	0.02	0.12	10,000	310	0.02	0.12
3010-0150	**R0.5**	20,000	1,500	0.025	0.15	10,000	375	0.025	0.15
3015-0225	**R0.75**	20,000	2,500	0.035	0.22	10,000	625	0.035	0.22
3020-0300	**R1**	24,000	4,000	0.1	0.4	12,000	1,000	0.1	0.4
3030-0450	**R1.5**	16,000	4,000	0.15	0.65	8,000	1,000	0.15	0.65
3040-0600	**R2**	12,000	4,000	0.2	0.85	6,000	1,000	0.2	0.85
3050-0750	**R2.5**	10,000	4,000	0.25	1	5,000	1,000	0.25	1
3060-0900	**R3**	8,000	4,000	0.3	1.3	4,000	1,000	0.3	1.3
3080-1200 (LS)	**R4**	6,000	4,000	0.4	1.7	3,000	900	0.35	1.6
3100-1500	**R5**	4,800	4,000	0.5	2.1	2,400	800	0.4	1.9
3120-1800	**R6**	4,000	4,000	0.6	2.6	2,000	800	0.45	2.2

Apply when a deep tool setting causes the toolholder to extend beyond the full shank diameter and over the taper angle.

Use the table below to adjust the parameters when compensating for extended overhang on the straight type design.

Work Material	Copper / Carbon Steels / Aluminum Alloys S45C, S50C, A5052, A7075 (～225HB)				Alloy Steels / Hardened Steels SKD / NAK (～45HRC)				Hardened Steels STAVAX / SKD61 (45～55HRC)			
Overhang Length	Spindle Speed	Feed Rate	a_p Axial Depth	a_e Radial Depth	Spindle Speed	Feed Rate	a_p Axial Depth	a_e Radial Depth	Spindle Speed	Feed Rate	a_p Axial Depth	a_e Radial Depth
～3D	×1	×1～1.5(※)	×1	×1	×1	×1	×1	×1	×1	×1	×1	×1
4D	×0.9	×0.9～1.2(※)	×1	×1	×0.9	×0.9	×1	×1	×0.9	×0.9	×1	×1
5D	×0.75	×0.75	×1	×1	×0.75	×0.75	×0.9	×0.9	×0.75	×0.75	×0.85	×0.9
6D	×0.6	×0.6	×1	×1	×0.6	×0.6	×0.85	×0.9	×0.6	×0.6	×0.8	×0.85
7D	×0.45	×0.4	×0.95	×0.95	×0.45	×0.4	×0.8	×0.85	×0.45	×0.4	×0.7	×0.8
8D	×0.35	×0.3	×0.9	×0.9	×0.35	×0.3	×0.7	×0.8	×0.35	×0.3	×0.6	×0.75

Work Material	Titanium Alloys / Stainless Steels Ti-6A l-4V / SUS				Heat Resistant Steels Inconel718			
Overhang Length	Spindle Speed	Feed Rate	a_p Axial Depth	a_e Radial Depth	Spindle Speed	Feed Rate	a_p Axial Depth	a_e Radial Depth
～3D	×1	×1	×1	×1	×1	×1	×1	×1
4D	×0.9	×0.9	×1	×1	×0.9	×0.9	×1	×1
5D	×0.75	×0.75	×0.95	×0.95	×0.75	×0.75	×0.85	×0.9
6D	×0.6	×0.6	×0.9	×0.9	×0.6	×0.6	×0.8	×0.85
7D	×0.45	×0.4	×0.85	×0.9	×0.45	×0.4	×0.7	×0.8
8D	×0.35	×0.3	×0.85	×0.85	×0.35	×0.3	×0.6	×0.75

(※) For high efficiency milling, set the feed rate higher. For improved surface finish and/or longer tool life, reduce the feed rate.

Milling Conditions for CFB

◆Finishing（overhang length ～6D）

WORK MATERIAL		Copper / Carbon Steels / Aluminum Alloys S45C / S50C / A5052 / A7075 (～225HB)				Alloy Steels / Hardened Steels SKD / NAK (～45HRC)				Hardened Steels STAVAX / SKD61 (45～55HRC)			
Coolant		WET				DRY / OIL MIST / WET				DRY / OIL MIST			
Model Number	Radius of Ball Nose (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
3020-0300	**R1**	53,000	4,000	0.05	0.04	45,000	3,400	0.05	0.04	36,800	2,200	0.05	0.04
3030-0450	**R1.5**	41,200	4,200	0.06	0.06	35,000	3,500	0.06	0.06	28,600	2,300	0.06	0.06
3040-0600	**R2**	29,400	4,400	0.08	0.08	24,000	3,700	0.08	0.08	20,400	2,400	0.08	0.08
3060-0900	**R3**	17,600	4,600	0.10	0.12	14,000	3,900	0.10	0.12	12,300	2,600	0.10	0.12
3080-1200	**R4**	14,600	4,600	0.10	0.16	12,400	3,900	0.10	0.16	10,200	2,600	0.10	0.16
3100-1500	**R5**	11,700	4,700	0.10	0.20	9,900	4,000	0.10	0.20	8,200	2,600	0.10	0.20
3120-1800	**R6**	8,800	4,800	0.10	0.24	7,400	4,000	0.10	0.24	6,200	2,700	0.10	0.24

WORK MATERIAL		Titanium Alloys / Stainless Steels Ti-6Al-4V / SUS				Heat Resistant Steels Inconel718			
Coolant		WET				WET			
Model Number	Radius of Ball Nose (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
3020-0300	**R1**	44,200	2,700	0.05	0.04	22,100	1,100	0.05	0.04
3030-0450	**R1.5**	34,400	2,800	0.06	0.06	17,200	1,100	0.06	0.06
3040-0600	**R2**	24,600	3,000	0.08	0.08	12,300	1,200	0.08	0.08
3060-0900	**R3**	14,800	3,200	0.10	0.12	7,400	1,300	0.10	0.12
3080-1200	**R4**	12,300	3,200	0.10	0.16	6,200	1,300	0.10	0.16
3100-1500	**R5**	9,900	3,200	0.10	0.20	5,000	1,300	0.10	0.20
3120-1800	**R6**	7,500	3,300	0.10	0.24	3,800	1,400	0.10	0.24

*When finishing with an overhang in excess of 6 x D, fine adjustments are recommended.

Milling Conditions for CFB

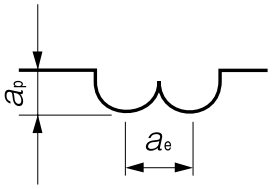
◆ Deep and high efficiency roughing（3xD overhang）

This parameter is effective in using the machine that has low acceleration and applying complex milling path that repearts accelerating/braking frequently.

WORK MATERIAL		Copper / Carbon Steels / Aluminum Alloys S45C / S50C / A5052 / A7075 (～225HB)				Alloy Steels / Hardened Steels SKD / NAK (～45HRC)			
Coolant		DRY（Unsuitable for Aluminum Alloys）/ WET				DRY / WET			
Model Number	Radius of Ball Nose (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
3020-0300	**R1**	30,000	2,500	0.4	0.8	30,000	2,500	0.4	0.8
3030-0450	**R1.5**	20,000	2,500	0.6	1.2	20,000	2,500	0.6	1.2
3040-0600	**R2**	15,000	2,500	0.8	1.6	15,000	2,500	0.8	1.6
3060-0900	**R3**	10,000	2,500	1.2	2.4	10,000	2,500	1.2	2.4
3080-1200	**R4**	7,100	2,350	1.6	3.2	7,100	2,350	1.6	3.2
3100-1500	**R5**	5,400	2,250	2	4	5,400	2,250	2	4
3120-1800	**R6**	4,500	2,250	2.4	4.8	4,500	2,250	2.4	4.8

WORK MATERIAL		Hardened Steels STAVAX / SKD61 (45～55HRC)				Titanium Alloys / Stainless Steels Ti-6Al-4V / SUS			
Coolant		DRY				WET			
Model Number	Radius of Ball Nose (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
3020-0300	**R1**	24,000	1,500	0.4	0.8	19,200	2,000	0.2	0.6
3030-0450	**R1.5**	16,000	1,500	0.6	1.2	12,800	2,000	0.3	0.9
3040-0600	**R2**	12,000	1,500	0.8	1.6	9,600	2,000	0.4	1.2
3060-0900	**R3**	8,000	1,500	1.2	2.4	6,400	2,000	0.6	1.8
3080-1200	**R4**	5,600	1,400	1.5	3	4,800	2,000	0.8	2.4
3100-1500	**R5**	4,300	1,300	1.7	3.5	3,900	2,000	1	3
3120-1800	**R6**	3,550	1,300	1.9	4.2	3,200	2,000	1.2	3.6

a_p : Axial Depth（mm）
a_e : Radial Depth（mm）



Note:
- Fix the work piece firmly, and use a machine that has high rigidity and generates a low level of vibration especially under high efficienct deep milling condition in roughing process.
- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when burr and red-hot occur.
- Decrease both spindle speed and feed rate 10% for slope milling.
- Decrease both spindle speed and feed rate to meet required precision and to prevent the shank making contact with the work piece.
- DRY: air blow, WET: water soluble or oil coolant.
- A long overhang may cause tool deflection, leaving uncut material, and making the work piece oversize.

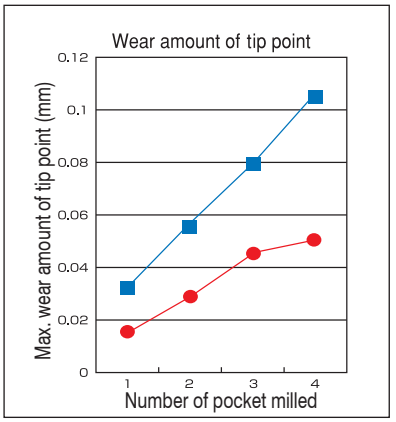
CFB Series SKD61(47HRC) Milling Video

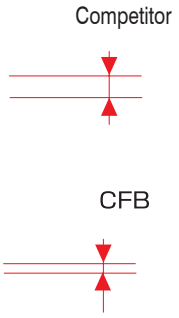
CFB combines roughing and finishing all in one tool.

Milling Example: Wear Comparison

Work Material: S50C Annealed Materials
Tool: CFB3060-0900 (R3, Length of Cut 9 mm)
Competitor's 3 flutes ball (R3, Length of Cut 9 mm)

	Roughing	Semi-finishing	Finishing
Spindle Speed	12,000 min^{-1}	12,000 min^{-1}	30,000 min^{-1}
Feed Rate	6,000 mm/min	6,000 mm/min	4,000 mm/min
Axial Depth $_pa$	0.6 mm	0.7 mm	0.12 mm
Radial Depth $_ea$	3 mm	0.7 mm	0.12 mm
Cycle Time	5 min	2 min	17 min
Coolant	Air Blow		
Pocket Size	55 mm x 50 mm x 23 mm depth		
Cycle Time/Pocket	24 min/pocket (4 pockets: 96 min)		



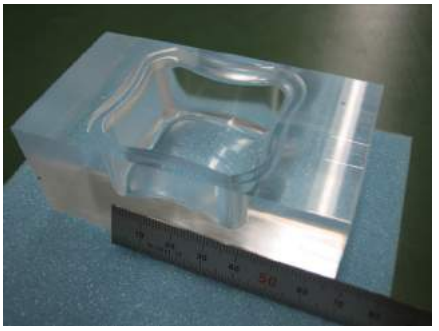


Wear point comparison
CFB : 0.050 mm
Competitor : 0.104 mm
2 x More Tool Life!

Milling Example: Acrylic Milling

Work Material: Acrylic
Tool: CFB3060-0900 (R3, Length of Cut 9 mm)

	Roughing	Semi-finishing	Finishing
Spindle Speed	12,000 min^{-1}	12,000 min^{-1}	30,000 min^{-1}
Feed Rate	6,000 mm/min	6,000 mm/min	4,000 mm/min
Axial Depth $_pa$	0.6 mm	0.7 mm	0.12 mm
Radial Depth $_ea$	3.0 mm	0.7 mm	0.12 mm
Cycle Time	5 min	2 min	17 min
Coolant	Water Soluble		
Pocket Size	55 mm x 50 mm x 23 mm depth		
Cycle Time/Pocket	24 min		



Mirror Surface Finish! Outstanding Transparency!

Size **R0.05~R6**

CSEB

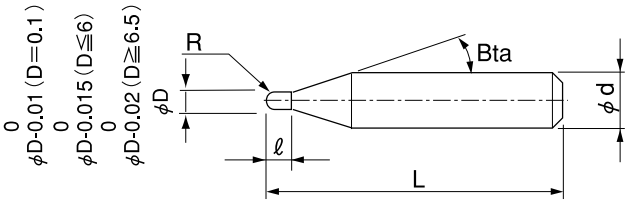
Super MG | UT COAT | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	◎			○	◎		◎			○	○		

Features

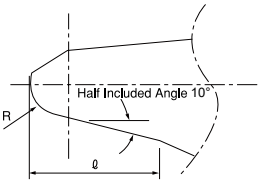
The robust geometry offers durability when roughing, yet gives excellent surface quality for finishing.
UTCOAT with improved hardness, durability, lubricity and adhesion offers better wear resistance and surface roughness.
Broad application range from raw materials to Hardened Steels (55HRC).



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

ATTENTION

CSEB 1001-0020-6 is a tapered ball end mill with single tapered flute of 10°(See the figure on right).



Radius of Ball Nose	Diameter Tolerance	Ballend Radius Tolerance	Helix Angle	Number of Flutes
R0.05	0/-0.01	R ±0.005	0°	2 Flutes *
R0.1 ~ R3	0/-0.015	R ±0.005	30°	
R3.25 ~ R6	0/-0.02	R ±0.007		

* Only CSEB1001-0020-6 has single flute.
R accuracy and diameter tolerance is same as R0.1.

Total 77 models **Unit (mm)**

Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
CSEB 1001-0020-6	R0.05	0.2	11°	50	6
CSEB 2001-0010	R0.05	0.1	11°	50	4
CSEB 2002-0020-6	R0.1	0.2	11°	50	6
CSEB 2002-0030		0.3	11°	50	4
CSEB 2003-0030	R0.15	0.3	11°	50	4
CSEB 2003-0030-6		0.3	11°	50	6
CSEB 2003-0045		0.45	11°	50	4
CSEB 2004-0040	R0.2	0.4	11°	50	4
CSEB 2004-0040-6		0.4	11°	50	6
CSEB 2004-0060		0.6	11°	50	4
CSEB 2005-0050	R0.25	0.5	11°	50	4
CSEB 2005-0050-6		0.5	11°	50	6
CSEB 2005-0075		0.75	11°	50	4
CSEB 2006-0060	R0.3	0.6	11°	50	4
CSEB 2006-0060-6		0.6	11°	50	6
CSEB 2006-0090		0.9	11°	50	4
CSEB 2007-0100	R0.35	1	11°	50	4
CSEB 2008-0080	R0.4	0.8	11°	50	4
CSEB 2008-0080-6		0.8	11°	50	6
CSEB 2008-0120		1.2	11°	50	4

Next Page ➡

Unit (mm)

Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
CSEB 2009-0130	R0.45	1.3	11°	50	4
CSEB 2010-0100	R0.5	1	11°	50	4
CSEB 2010-0100-6		1	11°	50	6
CSEB 2010-0150		1.5	11°	50	4
CSEB 2010-0250		2.5	11°	50	4
CSEB 2011-0160	R0.55	1.6	11°	50	4
CSEB 2012-0180	R0.6	1.8	11°	50	4
CSEB 2013-0190	R0.65	1.9	11°	50	4
CSEB 2014-0210	R0.7	2.1	11°	50	4
CSEB 2015-0150	R0.75	1.5	11°	50	4
CSEB 2015-0150-6		1.5	11°	50	6
CSEB 2015-0200		2	11°	50	4
CSEB 2015-0225		2.25	11°	50	4
CSEB 2015-0400		4	11°	50	4
CSEB 2016-0240	R0.8	2.4	11°	50	4
CSEB 2017-0250	R0.85	2.5	11°	50	4
CSEB 2018-0270	R0.9	2.7	11°	50	4
CSEB 2019-0280	R0.95	2.8	11°	50	4
CSEB 2020-0200	R1	2	11°	50	4
CSEB 2020-0200-6		2	11°	60	6
CSEB 2020-0300		3	11°	60	4
CSEB 2020-0600		6	11°	60	4
CSEB 2025-0250	R1.25	2.5	11°	50	4
CSEB 2025-0250-6		2.5	11°	60	6
CSEB 2025-0375		3.75	11°	50	4
CSEB 2025-0600		6	11°	60	4
CSEB 2030-0300	R1.5	3	11°	50	6
CSEB 2030-0450		4.5	11°	70	6
CSEB 2030-0800		8	11°	70	6
CSEB 2035-0520	R1.75	5.2	11°	70	6
CSEB 2040-0400	R2	4	11°	50	6
CSEB 2040-0600		6	11°	70	6
CSEB 2040-0800		8	11°	70	6
CSEB 2045-0670	R2.25	6.7	11°	70	6
CSEB 2050-0500	R2.5	5	11°	50	6
CSEB 2050-0750		7.5	11°	80	6
CSEB 2050-0800		8	11°	80	6
CSEB 2050-1200		12	11°	80	6
CSEB 2055-0820	R2.75	8.2	11°	80	6
CSEB 2060-0600	R3	6	-	50	6
CSEB 2060-0900		9	-	80	6
CSEB 2060-1200		12	-	80	6
CSEB 2065-0970	R3.25	9.7	11°	90	8
CSEB 2070-1050	R3.5	10.5	11°	90	8
CSEB 2075-1120	R3.75	11.2	11°	90	8
CSEB 2080-0800	R4	8	-	60	8
CSEB 2080-1200		12	-	90	8
CSEB 2080-1400		14	-	90	8
CSEB 2085-1270	R4.25	12.7	11°	100	10
CSEB 2090-1350	R4.5	13.5	11°	100	10
CSEB 2100-1000	R5	10	-	70	10
CSEB 2100-1500		15	-	100	10
CSEB 2100-1800		18	-	100	10
CSEB 2110-1650	R5.5	16.5	11°	110	12
CSEB 2120-1200	R6	12	-	75	12
CSEB 2120-1800		18	-	110	12
CSEB 2120-2200		22	-	110	12

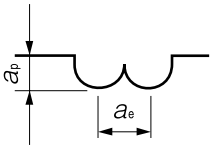
Milling Conditions for CSEB

WORK MATERIAL			COPPER / ALUMINUM ALLOYS				CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB)				PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC)				HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC)			
Model Number	Radius of Ball Nose (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
1001-0020-6	R0.05	0.2	30,000	30	0.002 or below	0.02	30,000	30	0.002 or below	0.02	30,000	30	0.002 or below	0.02	30,000	30	0.002 or below	0.02
2001-0010		0.1	30,000	200	0.004 or below	0.04	30,000	200	0.004 or below	0.04	30,000	200	0.004 or below	0.04	30,000	200	0.004 or below	0.04
2002-0020-6	R0.1	0.2	60,000	350	0.008	0.024	60,000	350	0.008	0.016	60,000	300	0.008	0.024	60,000	300	0.006	0.018
2002-0030		0.3	60,000	350	0.008	0.024	60,000	350	0.008	0.016	60,000	300	0.008	0.024	60,000	300	0.006	0.018
2003-0030(-6)	R0.15	0.3	43,000	500	0.012	0.036	43,000	500	0.012	0.024	54,000	450	0.012	0.036	43,000	450	0.008	0.024
2003-0045		0.45	43,000	500	0.012	0.036	43,000	500	0.012	0.024	54,000	450	0.012	0.036	43,000	450	0.008	0.024
2004-0040(-6)	R0.2	0.4	35,000	1,200	0.03	0.09	35,000	1,200	0.02	0.04	50,000	650	0.025	0.075	35,000	650	0.015	0.045
2004-0060		0.6	35,000	1,200	0.03	0.09	35,000	1,200	0.02	0.04	50,000	650	0.025	0.075	35,000	650	0.015	0.045
2005-0050(-6)	R0.25	0.5	34,000	1,300	0.035	0.105	34,000	1,300	0.03	0.06	45,000	900	0.03	0.09	32,000	900	0.02	0.06
2005-0075		0.75	34,000	1,300	0.035	0.105	34,000	1,300	0.03	0.06	45,000	900	0.03	0.09	32,000	900	0.02	0.06
2006-0060(-6)	R0.3	0.6	33,000	1,500	0.05	0.15	33,000	1,500	0.04	0.08	40,000	1,300	0.045	0.09	30,000	1,300	0.04	0.06
2006-0090		0.9	33,000	1,500	0.05	0.15	33,000	1,500	0.04	0.08	40,000	1,300	0.045	0.09	30,000	1,300	0.04	0.06
2007-0100	R0.35	1	32,000	1,800	0.07	0.21	32,000	1,600	0.05	0.1	38,000	1,600	0.06	0.12	28,000	1,600	0.05	0.075
2008-0080(-6)	R0.4	0.8	30,000	2,200	0.1	0.3	30,000	1,800	0.06	0.12	35,000	1,800	0.07	0.14	25,000	1,700	0.07	0.1
2008-0120		1.2	30,000	2,200	0.1	0.3	30,000	1,800	0.06	0.12	35,000	1,800	0.07	0.14	25,000	1,700	0.07	0.1
2009-0130	R0.45	1.3	30,000	2,100	0.11	0.33	30,000	1,600	0.07	0.14	33,000	1,700	0.08	0.16	24,000	1,600	0.08	0.12
2010-0100(-6)	R0.5	1	30,000	2,000	0.12	0.36	30,000	1,600	0.08	0.16	30,000	1,600	0.09	0.18	22,000	1,600	0.09	0.13
2010-0150		1.5	30,000	2,000	0.12	0.36	30,000	1,600	0.08	0.16	30,000	1,500	0.09	0.18	22,000	1,600	0.09	0.13
2010-0250		2.5	30,000	1,700	0.09	0.27	24,000	1,400	0.06	0.12	30,000	1,300	0.075	0.15	21,500	1,300	0.075	0.1
2011-0160	R0.55	1.6	30,000	2,000	0.12	0.36	30,000	1,600	0.08	0.16	30,000	1,600	0.09	0.18	20,000	1,600	0.09	0.13
2012-0180	R0.6	1.8	30,000	2,000	0.13	0.39	30,000	1,600	0.09	0.18	30,000	1,600	0.1	0.2	18,000	1,600	0.1	0.15
2013-0190	R0.65	1.9	30,000	2,000	0.13	0.39	30,000	1,600	0.09	0.18	30,000	1,700	0.1	0.2	18,000	1,500	0.1	0.15
2014-0210	R0.7	2.1	30,000	2,000	0.14	0.42	30,000	1,500	0.1	0.2	30,000	1,700	0.11	0.2	18,000	1,500	0.11	0.16
2015-0150(-6)	R0.75	1.5	30,000	2,000	0.15	0.45	30,000	1,600	0.12	0.24	30,000	1,700	0.12	0.24	18,000	1,500	0.12	0.18
2015-0200		2	30,000	2,000	0.15	0.45	30,000	1,600	0.12	0.24	30,000	1,700	0.12	0.24	18,000	1,500	0.12	0.18
2015-0225		2.25	30,000	2,000	0.15	0.45	30,000	1,600	0.12	0.24	30,000	1,700	0.12	0.24	18,000	1,500	0.12	0.18
2015-0400		4	30,000	1,800	0.12	0.36	23,000	1,200	0.08	0.16	30,000	1,400	0.1	0.2	15,000	1,200	0.09	0.13
2016-0240	R0.8	2.4	30,000	2,000	0.16	0.48	30,000	1,600	0.12	0.24	30,000	1,800	0.12	0.36	18,000	1,400	0.1	0.2
2017-0250	R0.85	2.5	30,000	2,000	0.17	0.51	30,000	1,700	0.14	0.28	30,000	1,800	0.14	0.42	18,000	1,400	0.12	0.24
2018-0270	R0.9	2.7	30,000	2,000	0.18	0.54	30,000	1,800	0.16	0.32	30,000	1,900	0.16	0.48	16,000	1,300	0.14	0.28
2019-0280	R0.95	2.8	30,000	2,000	0.19	0.57	30,000	1,900	0.18	0.36	30,000	1,900	0.18	0.54	16,000	1,300	0.16	0.32
2020-0200(-6)	R1	2	30,000	2,000	0.2	0.6	30,000	2,000	0.21	0.42	30,000	2,000	0.2	0.6	16,000	1,300	0.17	0.5
2020-0300		3	30,000	2,000	0.2	0.6	30,000	2,000	0.21	0.42	30,000	2,000	0.2	0.6	16,000	1,300	0.17	0.5
2020-0600		6	30,000	2,000	0.2	0.6	30,000	2,000	0.14	0.42	30,000	2,000	0.13	0.45	10,800	850	0.1	0.4

Milling Conditions for CSEB

WORK MATERIAL			COPPER / ALUMINUM ALLOYS				CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB)				PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC)				HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC)			
Model Number	Radius of Ball Nose (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2025-0250(-6)		2.5	27,000	2,300	0.28	0.75	27,000	2,300	0.25	0.5	27,000	2,300	0.25	0.75	13,000	1,100	0.21	0.63
2025-0375	**R1.25**	3.75	27,000	2,300	0.28	0.75	27,000	2,300	0.25	0.5	27,000	2,300	0.25	0.75	13,000	1,100	0.21	0.63
2025-0600		6	25,000	2,100	0.26	0.67	25,000	2,100	0.23	0.46	24,000	2,000	0.2	0.65	11,000	930	0.14	0.44
2030-0300		3	24,000	2,500	0.32	0.9	24,000	2,500	0.32	0.9	24,000	2,500	0.3	0.9	14,000	1,400	0.25	0.76
2030-0450	**R1.5**	4.5	24,000	2,500	0.32	0.9	24,000	2,500	0.32	0.9	24,000	2,500	0.3	0.9	14,000	1,400	0.25	0.76
2030-0800		8	22,000	2,300	0.28	0.7	22,000	2,300	0.28	0.7	20,000	2,000	0.2	0.65	10,700	1,000	0.18	0.54
2035-0520	**R1.75**	5.2	24,000	2,700	0.35	1	24,000	2,700	0.35	1	21,000	2,400	0.35	1	12,000	1,700	0.3	0.9
2040-0400		4	24,000	2,900	0.4	1.2	24,000	2,900	0.4	1.2	18,000	2,400	0.4	1.2	11,000	2,000	0.34	1
2040-0600	**R2**	6	24,000	2,900	0.4	1.2	24,000	2,900	0.4	1.2	18,000	2,400	0.4	1.2	11,000	2,000	0.34	1
2040-0800		8	24,000	2,900	0.4	1.2	24,000	2,900	0.4	1.2	18,000	2,400	0.4	1.2	11,000	2,000	0.34	1
2045-0670	**R2.25**	6.7	21,000	3,000	0.45	1.3	21,000	3,000	0.45	1.3	16,000	2,400	0.42	1.2	10,000	1,900	0.38	1.1
2050-0500		5	18,000	3,000	0.5	1.5	18,000	3,000	0.5	1.5	13,000	2,400	0.45	1.4	9,000	1,800	0.42	1.2
2050-0750	**R2.5**	7.5	18,000	3,000	0.5	1.5	18,000	3,000	0.5	1.5	13,000	2,400	0.45	1.4	9,000	1,800	0.42	1.2
2050-0800		8	18,000	3,000	0.5	1.5	18,000	3,000	0.5	1.5	13,000	2,400	0.45	1.4	9,000	1,800	0.42	1.2
2050-1200		12	18,000	3,000	0.5	1.5	18,000	3,000	0.5	1.5	13,000	2,400	0.45	1.4	9,000	1,800	0.42	1.2
2055-0820	**R2.75**	8.2	17,000	3,000	0.55	1.6	17,000	3,000	0.55	1.6	12,000	2,400	0.5	1.5	8,500	1,800	0.45	1.3
2060-0600		6	16,000	3,100	0.6	1.8	16,000	3,100	0.6	1.8	11,000	2,310	0.55	1.7	7,500	1,800	0.5	1.5
2060-0900	**R3**	9	16,000	3,100	0.6	1.8	16,000	3,100	0.6	1.8	11,000	2,310	0.55	1.7	7,500	1,800	0.5	1.5
2060-1200		12	16,000	3,100	0.6	1.8	16,000	3,100	0.6	1.8	11,000	2,310	0.55	1.7	7,500	1,800	0.5	1.5
2065-0970	**R3.25**	9.7	15,000	3,100	0.65	1.95	15,000	3,100	0.65	1.95	10,000	2,200	0.59	1.8	7,000	1,800	0.54	1.6
2070-1050	**R3.5**	10.5	14,000	3,200	0.7	2.1	14,000	3,200	0.7	2.1	9,000	2,100	0.63	1.9	6,500	1,800	0.57	1.7
2075-1120	**R3.75**	11.2	13,000	3,300	0.75	2.25	13,000	3,300	0.75	2.25	8,200	2,000	0.67	2	6,000	1,800	0.6	1.8
2080-0800		8	12,000	3,300	0.8	2.4	12,000	3,300	0.8	2.4	7,400	1,900	0.72	2.2	5,700	1,800	0.65	2
2080-1200	**R4**	12	12,000	3,300	0.8	2.4	12,000	3,300	0.8	2.4	7,400	1,900	0.72	2.2	5,700	1,800	0.65	2
2080-1400		14	12,000	3,300	0.8	2.4	12,000	3,300	0.8	2.4	7,400	1,900	0.72	2.2	5,700	1,800	0.65	2
2085-1270	**R4.25**	12.7	12,000	3,300	0.85	2.55	12,000	3,300	0.85	2.55	6,800	1,800	0.75	2.3	5,400	1,700	0.7	2.1
2090-1350	**R4.5**	13.5	11,000	3,400	0.9	2.7	11,000	3,400	0.9	2.7	6,300	1,700	0.8	2.4	5,100	1,600	0.75	2.2
2100-1000		10	10,000	3,500	1	3	10,000	3,500	1	3	5,200	1,650	0.9	2.7	4,600	1,500	0.85	2.5
2100-1500	**R5**	15	10,000	3,500	1	3	10,000	3,500	1	3	5,200	1,650	0.9	2.7	4,600	1,500	0.85	2.5
2100-1800		18	10,000	3,500	1	3	10,000	3,500	1	3	5,200	1,650	0.9	2.7	4,600	1,500	0.85	2.5
2110-1650	**R5.5**	16.5	9,000	3,400	1.1	3.3	9,000	3,400	1.1	3.3	4,700	1,500	1	3	4,200	1,350	0.9	2.7
2120-1200		12	8,400	3,300	1.2	3.6	8,400	3,300	1.2	3.6	4,300	1,350	1.1	3.2	3,800	1,250	1	3
2120-1800	**R6**	18	8,400	3,300	1.2	3.6	8,400	3,300	1.2	3.6	4,300	1,350	1.1	3.2	3,800	1,250	1	3
2120-2200		22	8,400	3,300	1.2	3.6	8,400	3,300	1.2	3.6	4,300	1,350	1.1	3.2	3,800	1,250	1	3

Note:
- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when burr and red-hot occur.
- Recommend oil coolant for Stainless Steels and Heat Resistant Steels.
- Recommend wet coolant for Copper.

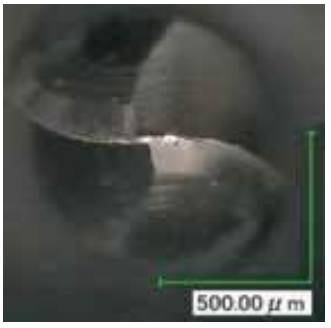


a_p : Axial Depth (mm)
a_e : Radial Depth (mm) = P_f

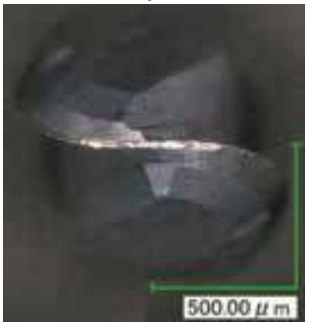
Milling Example: STAVAX (52HRC) Roughing

◆Contribution of Helix Ball & Small Relief CSEB 2010-0150

CSEB



Competitor

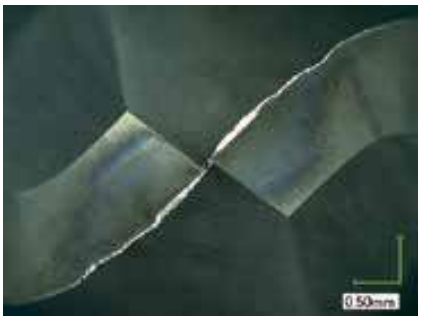


Tool Overhang: 15 mm	Spindle Speed: 30,000 min^{-1}
Feed Rate: 666 mm/min	Axial Depth: 0.05 mm
Radial Depth: 0.21 mm	Coolant: Air Blow (Nozzle)
Cycle Time: 30 min	Pocket Size: 20 × 20 × 0.5 mm

Milling Example: STAVAX (30HRC) Roughing

◆Contribution of Helix Ball & Small Relief CSEB 2060-0900

CSEB



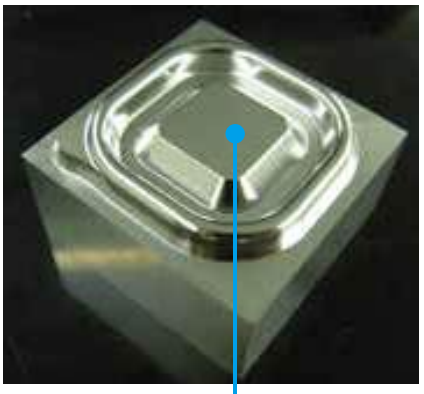
Competitor

Tool Overhang: 23 mm	Spindle Speed: 16,000 min^{-1}
Feed Rate: 3,380 mm/min	Axial Depth: 0.6 mm
Radial Depth: 1.8 mm	Coolant: Water Soluble (Nozzle)
Cycle Time: 120 min	Milling Shape: Tapered Circle x 40 pockets

Pocket Size: R12 mm (top) x 17 mm depth (Pocket tapered angle: 10°)

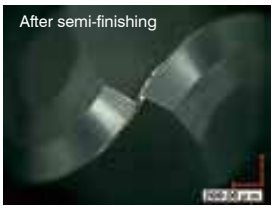
Milling Example: HPM38 (53HRC) Plastic Mold

◆Optimized Ball Tip Effect



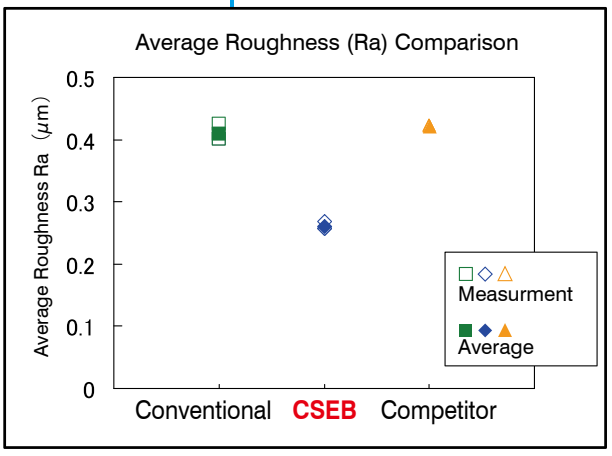
CSEB 2040-0600

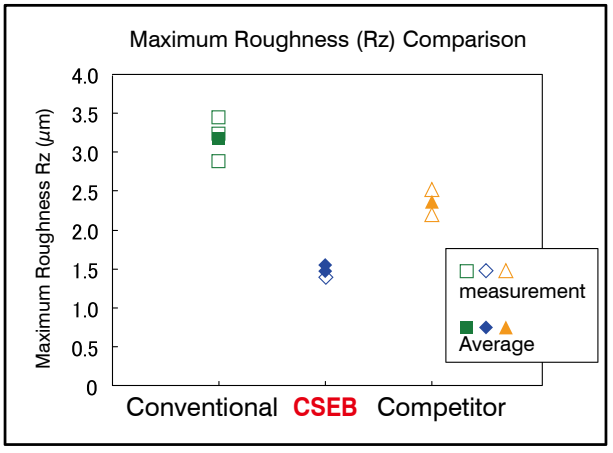
CSEB 2020-0300



CSEB 2010-0150

Work Size
50 mm × 50 mm × 30 mm





Optimized ball tip offers outstanding a nano-smooth surface on finishing.

No	Milling Process	Tool (Radius of Ball Nose × Length of Cut)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Axial Depth a_p (mm)	Radial Depth a_e (mm)	Overhang (mm)	Cycle Time (min)	Coolant
1	Roughing	CSEB2040-0600 (R2×6)	11,000	2,000	0.34	1	15	0:31:21	Air Blow
2	Semi-finishing	CSEB2020-0300 (R1×3)	16,000	1,300	0.17	0.5	13	0:03:10	Air Blow
3	Semi-finishing	CSEB2020-0300 (R1×3)	16,000	1,300	0.1	0.1	13	0:16:47	Air Blow
4	Semi-finishing	CSEB2020-0300 (R1×3)	16,000	1,300	0.01	0.1	13	0:37:00	Oil Mist
5	Finishing	CSEB2010-0150 (R0.5×1.5)	22,000	1,300	0.04	0.18	12	0:05:06	Oil Mist
6	Finishing	CSEB2010-0150 (R0.5×1.5)	22,000	700	0.05	0.05	12	0:59:36	Oil Mist
7	Finishing	CSEB2010-0150 (R0.5×1.5)	22,000	700	0.01	0.05	12	0:30:43	Oil Mist

4 Flutes HARDMAX

Size **R1~R6**

HFB

Super MG | HARD MAX | 40° | R ±0.005 (R1~R1.5) | R ±0.007 (R2~R3) | R ±0.01 (R4~R6) | Shank Dia 0/-0.005

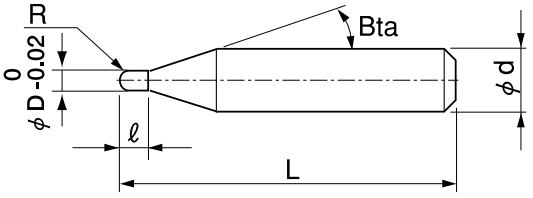
Patented in Japan, China, Korea, Taiwan, Germany, Switzerland, and Liechtenstein

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
			◎	◎	◎										

Features

Dramatically improved the milling efficiency. Maximum 27 times higher chip-flow comparing with conventional tool.
New ball tip design offers polish-less bottom surface finishing.
Affordable pricing.
Diameter Tolerance: +0/-0.02



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 8 models Unit (mm)

Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HFB 4020-0300	R1	3	16°	50	4
HFB 4020-0300-6	R1	3	16°	50	6
HFB 4030-0450	R1.5	4.5	16°	60	6
HFB 4040-0600	R2	6	16°	70	6
HFB 4060-0900	R3	9	-	80	6
HFB 4080-1200	R4	12	-	90	8
HFB 4100-1500	R5	15	-	100	10
HFB 4120-1800	R6	18	-	110	12

4 Flutes HARDMAX

Size **R1~R6**

HFB Short Shank

HFB-S

Super MG | HARD MAX | 40° | R ±0.005 (R1~R1.5) | R ±0.007 (R2~R3) | R ±0.01 (R4~R6) | Shank Dia 0/-0.005

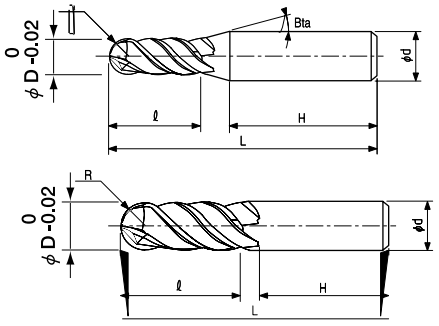
Patented in Japan, China, Korea, Taiwan, Germany, Switzerland, and Liechtenstein

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
			◎	◎	◎										

Features

Compatible with shrink-fit toolholder systems for high efficiency.
A shorter overhang offers higher feed rates and pecision.
Diameter Tolerance +0/-0.02



The shank taper angle and the shank length (H) shown are not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 7 models **Unit (mm)**

Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Shank Length H
HFB 4020-0300S	R1	3	16°	40	4	31.0
HFB 4030-0450S	R1.5	4.5	16°	40	4	30.5
HFB 4040-0600S	R2	6	16°	45	6	32.5
HFB 4060-0900S	R3	9	-	50	6	34.5
HFB 4080-1200S	R4	12	-	60	8	40.5
HFB 4100-1500S	R5	15	-	60	10	35.5
HFB 4120-1800S	R6	18	-	60	12	31.5

Milling Conditions for HFB / HFB-S

◆Roughing

WORK MATERIAL		Prehardened Steels NAK80 (35~45HRC) Coolant: Water Soluble / Air Blow / Oil Mist				Hardened Steels STAVAX / SKD61 (45~55HRC) Coolant: Air Blow / Oil Mist			
Model Number	Radius of Ball Nose (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4020-0300	**R1**	20,000	1,500	0.5	0.8	16,000	1,500	0.6	0.9
4030-0450	**R1.5**	16,000	2,000	0.6	0.9	10,500	1,500	0.9	1.35
4040-0600	**R2**	15,000	3,000	0.4	0.8	9,000	3,000	0.7	1.4
4060-0900	**R3**	9,000	2,500	0.5	1	8,000	3,500	0.6	1.8
4080-1200	**R4**	CFB Series are Recommended				6,200	3,000	0.75	2.1
4100-1500	**R5**					4,500	2,700	0.85	2.5
4120-1800	**R6**					3,750	2,700	0.95	3

WORK MATERIAL		Hardened Steels YXR33 / SKD11 (55~60HRC) Coolant: Air Blow / Oil Mist				Hardened Steels HAP10 / SKD11 / YXR7 (60~65HRC) Coolant: Air Blow / Oil Mist			
Model Number	Radius of Ball Nose (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4020-0300	**R1**	10,000	1,500	0.4	0.8	8,500	1,200	0.3	0.7
4030-0450	**R1.5**	6,500	1,500	0.6	1.2	5,500	1,200	0.5	1.1
4040-0600	**R2**	5,500	1,750	0.6	1.2	6,200	2,000	0.45	1
4060-0900	**R3**	4,500	1,750	0.6	1.5	5,000	2,000	0.45	1.2
4080-1200	**R4**	3,750	1,500	0.7	1.75	4,500	1,800	0.5	1.4
4100-1500	**R5**	3,000	1,500	0.75	2	3,600	1,800	0.6	1.6
4120-1800	**R6**	2,500	1,500	0.9	2.4	3,000	1,800	0.7	1.8

WORK MATERIAL		Hardened Steels HAP72 (65~70HRC) Coolant: Air Blow / Oil Mist			
Model Number	Radius of Ball Nose (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4020-0300	**R1**	10,500	750	0.2	0.6
4030-0450	**R1.5**	7,000	750	0.25	0.8
4040-0600	**R2**	7,500	1,200	0.2	0.6
4060-0900	**R3**	5,000	1,500	0.3	0.9
4080-1200	**R4**	4,000	1,500	0.3	1
4100-1500	**R5**	3,000	1,500	0.3	1.2
4120-1800	**R6**	2,500	1,300	0.3	1.4

Milling Conditions for HFB / HFB-S

Please adjust milling parameter referning following table.

Ball half diameter R1（⌀ 4 shank）、R1.5

Overhang Length	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
⌀D×5 or below	×1	×1	×1	×1
～⌀D×6	×0.9	×0.9	×0.95	×0.95
～⌀D×7	×0.8	×0.8	×0.9	×0.95
～⌀D×8	×0.7	×0.7	×0.85	×0.9
～⌀D×9	×0.65	×0.6	×0.8	×0.9
～⌀D×10	×0.55	×0.5	×0.75	×0.85

Ball half diameter R1（⌀ 6 shank）

Overhang Length	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
⌀D×6	×1	×1	×1	×1
～⌀D×7	×0.85	×0.9	×0.95	×0.95
～⌀D×8	×0.7	×0.8	×0.9	×0.9
～⌀D×9	×0.55	×0.75	×0.85	×0.9
～⌀D×10	×0.4	×0.65	×0.8	×0.85

Ball half diameter R1.5（Short shank）

Overhang Length	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
⌀D×5 or below	×1	×1	×1	×1
～⌀D×6	×0.55	×0.3	×0.4	×0.55

Ball half diameter R2

Overhang Length	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
⌀D×3 or below	×1	×1	×1	×1
～⌀D×3.5	×1	×0.85	×0.85	×0.9
～⌀D×4	×1	×0.8	×0.7	×0.8
～⌀D×4.5	×0.85	×0.55	×0.6	×0.75
～⌀D×5	×0.7	×0.35	×0.6	×0.75
～⌀D×5.5	×0.55	×0.25	×0.55	×0.7
～⌀D×6	×0.4	×0.15	×0.5	×0.7

HFB Series
SKD11(60HRC)
Milling Video

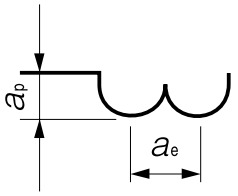
*** Refer to next page for finishing condition.**

Milling Conditions for HFB / HFB-S

◆ Finishing（overhang length ~6D）

WORK MATERIAL		Prehardened Steels/Hardened Steels (35~60HRC) Coolant: Oil Mist			
Model Number	Radius of Ball Nose (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
4020-0300	**R1**	26,000	2,000	0.02	0.06
4030-0450	**R1.5**	25,000	1,800	0.03	0.07
4040-0600	**R2**	22,500	1,500	0.04	0.08
4060-0900	**R3**	15,000	1,000	0.06	0.12
4080-1200	**R4**	11,250	750	0.08	0.16
4100-1500	**R5**	9,000	600	0.1	0.2
4120-1800	**R6**	7,500	500	0.12	0.24

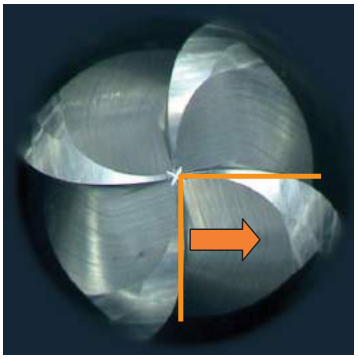
a_p : Axial Depth（mm）
a_e : Radial Depth（mm）



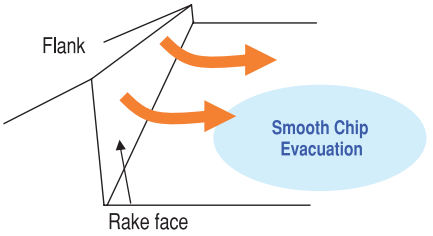
Note:
・Decrease the feed rate more than 50% from the milling parameters when slot milling.
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when burr and red-hot occur.
・Adjustments are recommended when finishing with an overhang in excess of 6xD.
・Recommend air blow or oil mist. For materials under 45HRC, recommend water soluble coolant.

Feature 1　Special Design Achieves Outstanding Chip Evacuation

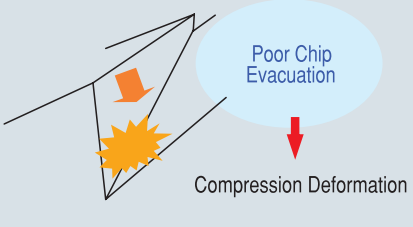
HFB Design



Flat (Non-rolled up) chip shape helps smooth chip evacuation.

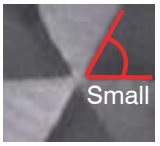
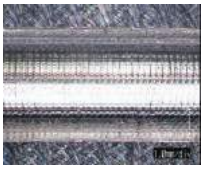
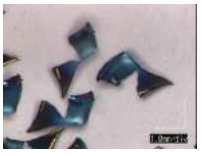


Conventional Design



4 Flutes HARDMAX

Smooth chip evacuation achieves more stable milling.

	HFB	Competitor A	Competitor B
Tip Point			
Milling Surface			
Chip Condition			

Tool	R2
Work Material	YXR33 (58HRC)
Spindle Speed	6,000 min^{-1}
Feed Rate	2,400 mm/min (Slotting : 1,200 mm/min)
Axial Depth a_p	1 mm (0.25D)
Radial Depth a_e	1 mm (0.25D)
Overhang	15 mm
Coolant	Air Blow (Through Spindle)
Pocket Size	100 mm × 20 mm × 6 mm (X × Y × Z)
Cycle Time	28.2 min

D : Outside Diameter

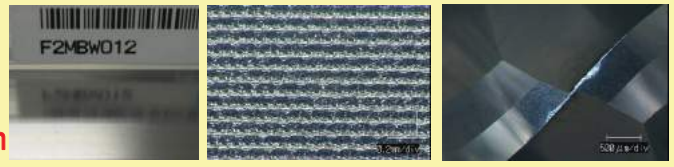
The large pocket design of the HFB promotes better chip evacuation and longer tool life when compared to a conventional design which shows premature damage.

Feature 2 Surface Finish Performance

STAVAX (53HRC) Milling Example: Surface Finishing HFB (R3)

HFB R3
Max Roughness
Rz: 0.9 μm

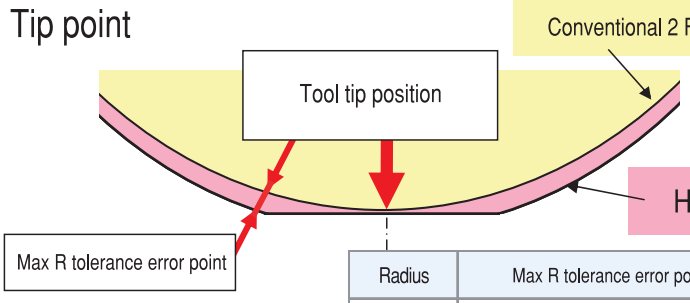
Conventional
2 Flutes
Max Roughness
Rz: 6.43 μm



Spindle Speed	12,800 min^{-1}
Feed Rate	2,500 mm/min
Axial Depth a_p	0.06 mm (0.01D)
Radial Depth a_e	0.12 mm (0.02D)
Coolant	Oil Mist

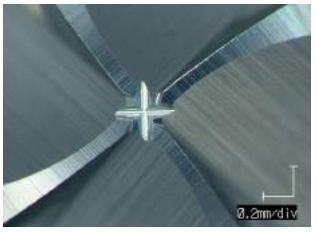
4 groves on the tip point help surface finishing process. Max roughness values was 0.9 μm on 1hour testing.
The tool condition is better than conventional 2 Flutes.

Tip point



Radius	Max R tolerance error point	HFB R Tolerance
R2・R3	under+ 5 μm or below	± 7 μm
R4・R5	under+ 7 μm or below	± 10 μm
R6	under+ 10 μm or below	

4 Tip Point Grooves



4 tip point groove can achieve longer tool life.

2 Flutes UTCOAT

Size **R0.5~R3**

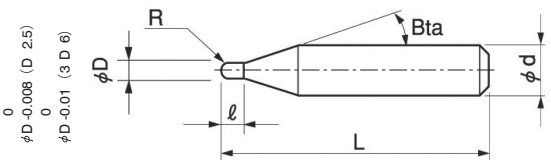
HGB

Super MG | HMG COAT | 30° | R ±0.003 (R0.5~R2) | R ±0.005 (R2.5~R3) | Shank Dia 0/-0.004

NEW

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS ~ 55HRC	HARDENED STEELS ~ 60HRC	HARDENED STEELS ~ 70HRC	CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE	HARD BRITTLE (NON-METALLIC) MATERIALS
		○	◎	◎	◎										



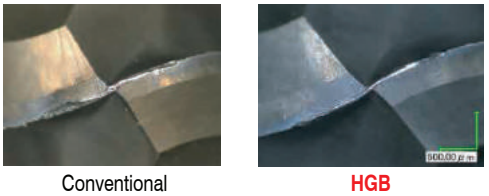
The shank taper angle shown is not an exact value and to avoid contact with the workpiece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 8 models **Unit (mm)**

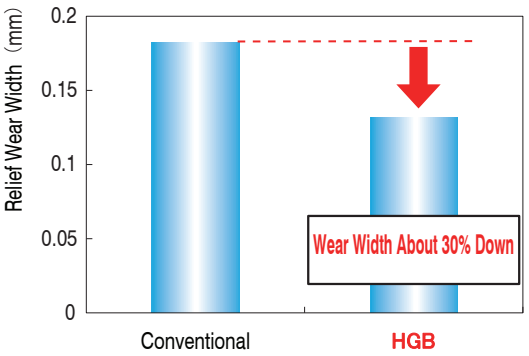
Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HGB 2010-0150	R0.5	1.5	16°	50	4
HGB 2015-0225	R0.75	2.25	16°	50	4
HGB 2020-0300	R1	3	16°	50	4
HGB 2025-0375	R1.25	3.75	16°	50	4
HGB 2030-0450	R1.5	4.5	16°	50	6
HGB 2040-0600	R2	6	16°	50	6
HGB 2050-0750	R2.5	7.5	16°	50	6
HGB 2060-0900	R3	9	-	50	6

Wear Comparison HGB R3 × 9 **Length of Cut** HAP10 (64HRC)

Tools after milling



Conventional HGB



Tool	HGB 2060-0900
Spindle Speed	6,840 min^{-1}
Feed Rate	2,640 mm/min
Axial Depth a_p	0.25 mm
Radial Depth a_e	1 mm
Coolant	Air Blow (Through-Spindle)
Milling Shape	Square Pocket (55 x 17.5 x Depth 6.9 mm) × 5 Pockets
Cycle Time	75 min

Size **R0.03~R6**

HSB

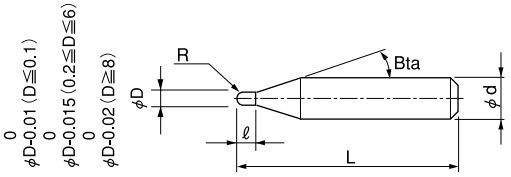
Super MG | HARD MAX | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
○	○	◎	◎	◎	◎	○			○			○	○		

Features

Offers high efficiency, long tool life and excellent surface finish on hard materials over 40HRC.
New and harder HARDMAX coat is adopted maintaining heat resistance, durability and lubricity at a high level.
Every coolant offers stable milling.
Ball tip point is designed with a negative rake angle that minimizes wear and improves the target dimensions.
The low negative rake angle at the peripheral side of the ball offers an excellent surface finish and prevents deflection.



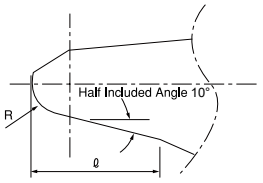
The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Radius of Ball Nose	Diameter Tolerance	Radius Accuracy	Helix Angle	Number of Flutes
R0.03 ~ R0.05	0/-0.01	R ±0.002	0°	2 Flutes *
R0.1 ~ R3	0/-0.015	R ±0.005	30°	
R4 ~ R6	0/-0.02	R ±0.007		

* Only HSB1001-0020-6 has single flute.
R accuracy: +-0.005, Diameter tolerance: 0/-0.015

ATTENTION

HSB 1001-0020-6 (R0.05) is a tapered ball end mill with single tapered flute of 10˚ (See the figure on right).



Total 70 models **Unit (mm)**

Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HSB20006-0006	R0.03	0.06	11°	50	4
HSB20008-0008	R0.04	0.08	11°	50	4
HSB1001-0020-6	R0.05	0.2	11°	50	6
HSB2001-0010	R0.05	0.1	11°	50	4
HSB2002-0020-6	R0.1	0.2	16°	50	6
HSB2002-0030		0.3		50	4
HSB2003-0030	R0.15	0.3	16°	50	4
HSB2003-0030-6		0.3		50	6
HSB2003-0045		0.45		50	4
HSB2004-0040	R0.2	0.4	16°	50	4
HSB2004-0040-6		0.4		50	6
HSB2004-0060		0.6		50	4
HSB2005-0050	R0.25	0.5	16°	50	4
HSB2005-0050-6		0.5		50	6
HSB2005-0075		0.75		50	4

Next Page ➡

Unit（mm）

Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød
HSB2006-0060	R0.3	0.6	16°	50	4
HSB2006-0060-6		0.6		50	6
HSB2006-0090		0.9		50	4
HSB2007-0100	R0.35	1	16°	50	4
HSB2008-0080	R0.4	0.8	16°	50	4
HSB2008-0080-6		0.8		50	6
HSB2008-0120		1.2		50	4
HSB2009-0130	R0.45	1.3	16°	50	4
HSB2010-0100	R0.5	1	16°	50	4
HSB2010-0100-6		1		50	6
HSB2010-0150		1.5		50	4
HSB2010-0250		2.5		50	4
HSB2011-0160	R0.55	1.6	16°	50	4
HSB2012-0180	R0.6	1.8	16°	50	4
HSB2013-0190	R0.65	1.9	16°	50	4
HSB2014-0210	R0.7	2.1	16°	50	4
HSB2015-0150	R0.75	1.5	16°	50	4
HSB2015-0150-6		1.5		50	6
HSB2015-0200		2		50	4
HSB2015-0225		2.25		50	4
HSB2015-0400		4		50	4
HSB2016-0240	R0.8	2.4	16°	50	4
HSB2017-0250	R0.85	2.5	16°	50	4
HSB2018-0270	R0.9	2.7	16°	50	4
HSB2019-0280	R0.95	2.8	16°	50	4
HSB2020-0200	R1	2	16°	50	4
HSB2020-0200-6		2		60	6
HSB2020-0300		3		50	4
HSB2020-0600		6		60	4
HSB2025-0250	R1.25	2.5	16°	50	4
HSB2025-0250-6		2.5		60	6
HSB2025-0375		3.75		50	4
HSB2025-0600		6		60	4
HSB2030-0300	R1.5	3	16°	50	6
HSB2030-0450		4.5		70	6
HSB2030-0800		8		70	6
HSB2040-0400	R2	4	16°	50	6
HSB2040-0600		6		70	6
HSB2040-0800		8		70	6
HSB2050-0500	R2.5	5	16°	50	6
HSB2050-0750		7.5		80	6
HSB2050-0800		8		80	6
HSB2050-1200		12		80	6
HSB2060-0600	R3	6	-	50	6
HSB2060-0900		9		80	6
HSB2060-1200		12		80	6
HSB2080-0800	R4	8	-	60	8
HSB2080-1200		12		90	8
HSB2080-1400		14		90	8
HSB2100-1000	R5	10	-	70	10
HSB2100-1500		15		100	10
HSB2100-1800		18		100	10
HSB2120-1200	R6	12	-	75	12
HSB2120-1800		18		110	12
HSB2120-2200		22		110	12

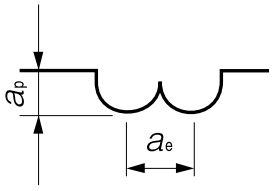
Milling Conditions for HSB / HSB-S

WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Radius of Ball Nose (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
20006-0006	**R0.03**	0.06	30,000	100	0.002 or below	0.02	-	-	-	-	-	-	-	-	-	-	-	-
20008-0008	**R0.04**	0.08	30,000	130	0.003 or below	0.03	-	-	-	-	-	-	-	-	-	-	-	-
1001-0020-6	**R0.05**	0.2	30,000	30	0.002 or below	0.02	-	-	-	-	-	-	-	-	-	-	-	-
2001-0010		0.1	30,000	200	0.004 or below	0.04	-	-	-	-	-	-	-	-	-	-	-	-
2002-0020 (-6)	**R0.1**	0.2	60,000	200	0.003	0.005	60,000	200	0.002	0.003	60,000	130	0.002	0.003	45,000	65	0.002	0.003
2002-0030		0.3	60,000	200	0.003	0.005	60,000	200	0.002	0.003	60,000	130	0.002	0.003	45,000	65	0.002	0.003
2003-0030 (-6)	**R0.15**	0.3	60,000	350	0.006	0.008	45,000	310	0.004	0.007	43,500	180	0.003	0.005	32,500	90	0.003	0.005
2003-0045		0.45	60,000	350	0.006	0.008	45,000	310	0.004	0.007	43,500	180	0.003	0.005	32,500	90	0.003	0.005
2004-0040 (-6)	**R0.2**	0.4	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008	26,250	120	0.005	0.008
2004-0060		0.6	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008	26,250	120	0.005	0.008
2005-0050 (-6)	**R0.25**	0.5	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01	22,500	150	0.007	0.01
2005-0075		0.75	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01	22,500	150	0.007	0.01
2006-0060 (-6)	**R0.3**	0.6	40,000	1,100	0.03	0.13	30,000	1,200	0.02	0.1	26,500	800	0.01	0.075	20,000	400	0.01	0.075
2006-0090		0.9	40,000	1,100	0.03	0.13	30,000	1,200	0.02	0.1	26,500	800	0.01	0.075	20,000	400	0.01	0.075
2007-0100	**R0.35**	1	37,000	1,350	0.045	0.17	28,500	1,400	0.03	0.135	25,000	900	0.015	0.1	18,750	450	0.015	0.1
2008-0080 (-6)	**R0.4**	0.8	35,000	1,600	0.06	0.21	27,000	1,600	0.04	0.17	23,500	1,000	0.02	0.12	17,500	500	0.02	0.12
2008-0120		1.2	35,000	1,600	0.06	0.21	27,000	1,600	0.04	0.17	23,500	1,000	0.02	0.12	17,500	500	0.02	0.12
2009-0130	**R0.45**	1.3	32,500	1,650	0.1	0.28	25,500	1,800	0.055	0.21	22,000	1,300	0.025	0.14	16,500	650	0.025	0.14
2010-0100 (-6)		1	30,000	1,750	0.2	0.4	24,000	2,000	0.1	0.3	21,000	1,750	0.05	0.2	16,000	875	0.05	0.2
2010-0150	**R0.5**	1.5	30,000	1,750	0.2	0.4	24,000	2,000	0.1	0.3	21,000	1,750	0.05	0.2	16,000	875	0.05	0.2
2010-0250		2.5	30,000	1,750	0.1	0.3	24,000	2,000	0.05	0.2	21,000	1,750	0.03	0.17	16,000	875	0.03	0.17
2011-0160	**R0.55**	1.6	30,000	1,900	0.21	0.43	22,000	2,000	0.105	0.32	19,000	1,750	0.05	0.22	14,250	875	0.05	0.22
2012-0180	**R0.6**	1.8	30,000	2,000	0.22	0.46	20,500	2,000	0.11	0.34	17,800	1,750	0.05	0.23	13,350	875	0.05	0.23
2013-0190	**R0.65**	1.9	30,000	2,150	0.23	0.49	19,000	2,000	0.115	0.36	16,600	1,750	0.05	0.24	12,450	875	0.05	0.24
2014-0210	**R0.7**	2.1	30,000	2,300	0.24	0.52	18,000	2,000	0.12	0.39	15,700	1,750	0.055	0.27	11,800	875	0.055	0.27
2015-0150 (-6)		1.5	30,000	2,450	0.25	0.55	17,000	2,000	0.12	0.4	15,000	1,750	0.06	0.29	11,250	875	0.06	0.29
2015-0200	**R0.75**	2	30,000	2,450	0.25	0.55	17,000	2,000	0.12	0.4	15,000	1,750	0.06	0.29	11,250	875	0.06	0.29
2015-0225		2.25	30,000	2,450	0.25	0.55	17,000	2,000	0.12	0.4	15,000	1,750	0.06	0.29	11,250	875	0.06	0.29
2015-0400		4	30,000	2,450	0.15	0.45	17,000	2,000	0.07	0.31	15,000	1,750	0.04	0.24	11,250	875	0.04	0.24
2016-0240	**R0.8**	2.4	30,000	2,550	0.25	0.58	16,200	2,000	0.13	0.43	14,200	1,750	0.06	0.3	10,650	875	0.06	0.3
2017-0250	**R0.85**	2.5	30,000	2,600	0.26	0.61	15,500	2,000	0.135	0.46	13,500	1,750	0.065	0.32	10,100	875	0.065	0.32
2018-0270	**R0.9**	2.7	30,000	2,700	0.28	0.65	15,000	2,000	0.14	0.48	13,000	1,750	0.07	0.34	9,750	875	0.07	0.34
2019-0280	**R0.95**	2.8	29,000	2,800	0.3	0.69	14,500	2,000	0.145	0.49	12,600	1,750	0.075	0.36	9,450	875	0.075	0.36
2020-0200 (-6)		2	28,000	2,900	0.3	0.7	14,000	2,100	0.15	0.5	12,250	1,800	0.08	0.35	9,200	900	0.08	0.35
2020-0300	**R1**	3	28,000	2,900	0.3	0.7	14,000	2,100	0.15	0.5	12,250	1,800	0.08	0.35	9,200	900	0.08	0.35
2020-0600		6	28,000	2,900	0.2	0.6	14,000	2,100	0.1	0.4	12,250	1,800	0.06	0.3	9,200	900	0.06	0.3
2025-0250 (-6)		2.5	24,500	2,950	0.35	0.85	12,250	2,150	0.17	0.6	10,700	1,850	0.1	0.45	8,050	925	0.1	0.45
2025-0375	**R1.25**	3.75	24,500	2,950	0.35	0.85	12,250	2,150	0.17	0.6	10,700	1,850	0.1	0.45	8,050	925	0.1	0.45
2025-0600		6	24,500	2,950	0.26	0.75	12,250	2,150	0.125	0.5	10,700	1,850	0.08	0.4	8,050	925	0.08	0.4
2030-0300		3	21,000	3,000	0.4	1	10,500	2,200	0.2	0.7	9,200	1,900	0.12	0.55	6,900	950	0.12	0.55
2030-0450	**R1.5**	4.5	21,000	3,000	0.4	1	10,500	2,200	0.2	0.7	9,200	1,900	0.12	0.55	6,900	950	0.12	0.55
2030-0800		8	21,000	3,000	0.3	0.9	10,500	2,200	0.15	0.65	9,200	1,900	0.1	0.5	6,900	950	0.1	0.5
2040-0400		4	18,000	3,200	0.5	1.3	9,000	2,300	0.25	0.95	7,900	2,000	0.15	0.75	5,900	1,000	0.15	0.75
2040-0600	**R2**	6	18,000	3,200	0.5	1.3	9,000	2,300	0.25	0.95	7,900	2,000	0.15	0.75	5,900	1,000	0.15	0.75
2040-0800		8	18,000	3,200	0.5	1.3	9,000	2,300	0.25	0.95	7,900	2,000	0.15	0.75	5,900	1,000	0.15	0.75
2050-0500		5	15,600	3,500	0.5	1.5	7,800	2,500	0.25	1.05	6,800	2,100	0.15	0.85	5,100	1,050	0.15	0.85
2050-0750	**R2.5**	7.5	15,600	3,500	0.5	1.5	7,800	2,500	0.25	1.05	6,800	2,100	0.15	0.85	5,100	1,050	0.15	0.85
2050-0800		8	15,600	3,500	0.5	1.5	7,800	2,500	0.25	1.05	6,800	2,100	0.15	0.85	5,100	1,050	0.15	0.85
2050-1200		12	15,600	3,500	0.5	1.5	7,800	2,500	0.25	1.05	6,800	2,100	0.15	0.85	5,100	1,050	0.15	0.85

Milling Conditions for HSB / HSB-S

WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Radius of Ball Nose (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2060-0600	**R3**	6	13,000	3,500	0.6	1.8	6,500	2,500	0.3	1.3	5,700	2,200	0.2	1	4,300	1,100	0.2	1
2060-0900		9	13,000	3,500	0.6	1.8	6,500	2,500	0.3	1.3	5,700	2,200	0.2	1	4,300	1,100	0.2	1
2060-1200		12	13,000	3,500	0.6	1.8	6,500	2,500	0.3	1.3	5,700	2,200	0.2	1	4,300	1,100	0.2	1
2080-0800	**R4**	8	9,500	3,000	0.7	2.1	5,200	2,200	0.4	1.7	4,500	1,900	0.25	1.35	3,400	950	0.25	1.35
2080-1200		12	9,500	3,000	0.7	2.1	5,200	2,200	0.4	1.7	4,500	1,900	0.25	1.35	3,400	950	0.25	1.35
2080-1400		14	9,500	3,000	0.7	2.1	5,200	2,200	0.4	1.7	4,500	1,900	0.25	1.35	3,400	950	0.25	1.35
2100-1000	**R5**	10	7,500	2,500	0.8	2.5	4,300	2,000	0.5	2.1	3,750	1,750	0.3	1.7	2,800	875	0.3	1.7
2100-1500		15	7,500	2,500	0.8	2.5	4,300	2,000	0.5	2.1	3,750	1,750	0.3	1.7	2,800	875	0.3	1.7
2100-1800		18	7,500	2,500	0.8	2.5	4,300	2,000	0.5	2.1	3,750	1,750	0.3	1.7	2,800	875	0.3	1.7
2120-1200	**R6**	12	6,200	2,000	0.9	3	3,600	1,750	0.6	2.6	3,150	1,500	0.35	2	2,350	750	0.35	2
2120-1800		18	6,200	2,000	0.9	3	3,600	1,750	0.6	2.6	3,150	1,500	0.35	2	2,350	750	0.35	2
2120-2200		22	6,200	2,000	0.9	3	3,600	1,750	0.6	2.6	3,150	1,500	0.35	2	2,350	750	0.35	2

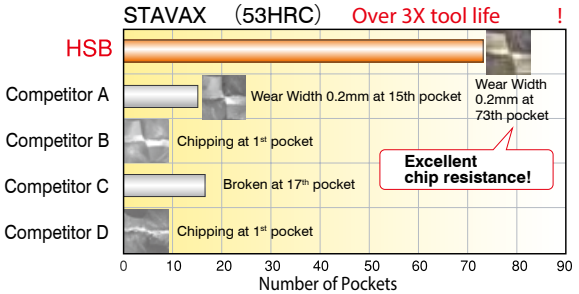
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

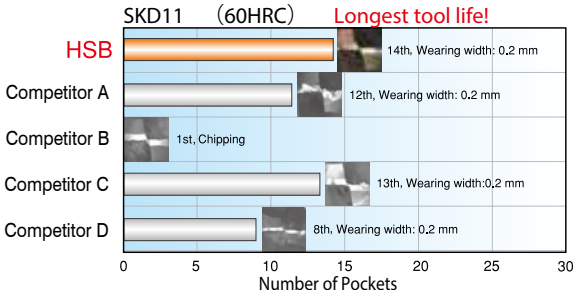


Note:
- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when burr and red-hot occur.
- Reduce the milling parameters when a straight shank tool exceeds 35 mm of overhang length.
- Every coolant offers stable milling.

R3 Ball Tool Life Comparison: Market Leading Performance on Wear Resistance!

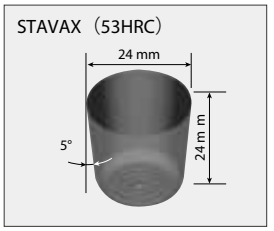
HSB offers the highest wear resistance for various work materials.

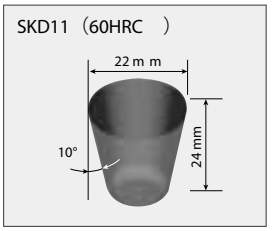




Tool Size: R3

Work Materia l		STAVAX (53HRC)	SKD11 (60HRC)
Spindle Speed	n	13,000 mi n^{-1}	6,500 mi n^{-1}
Feed Rat e	V_f	3,500 mm/mi n	2,500 mm/mi n
Velocity	V_c	245 m/mi n	122 m/mi n
Feed per toot h	f_z	0.135 mm/toot h	0.19 mm/toot h
Axial Dept h a_p	a_p	0.6 mm	0.3 m m
Radial Dept h a_e	a_e	1.8 mm	1.3 m m
Overhang Lengt h		30 mm	30 mm
Cycle Tim e		3 minutes/pocket	6.5 minutes/pocket
Coolant		Air Blow	
Milling Method		Contourin g	





Size **R0.1~R2**

NEW

Short Shank Series

HSB-S

Super MG | HARD MAX | 30° | R ±0.003 | Shank Dia 0/-0.004

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
○	○	◎	◎	◎	◎	○			○			○	○		

Features

Short Shank Ball End Mills for high accuracy shrink-fit holder.
Offers high efficiency, long tool life and excellent surface finish on hard materials over 40HRC.
New and harder HARDMAX coat is adopted maintaining heat resistance, durability and lubricity at a high level.
Every coolant offers stable milling.
Ball tip point is designed with a negative rake angle that minimizes wear and improves the target dimensions.
The low negative rake angle at the peripheral side of the ball offers an excellent surface finish and prevents deflection.

Tighter Tolerance Design! Diameter Tolerance, Ball Radius Accuracy, and Shank Diameter Tolerance

HSB / HSLB Tolerance

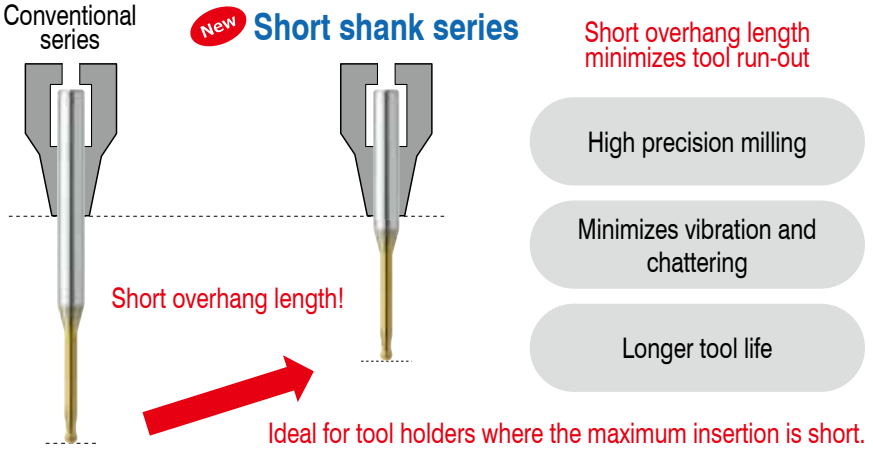
Radius of Ball Nose	Diameter Tolerance	Ball Radius Accuracy	Shank Diameter Tolerance
R0.1 ~ R3	0/-0.015	± 0.005	0/-0.005 (h5)

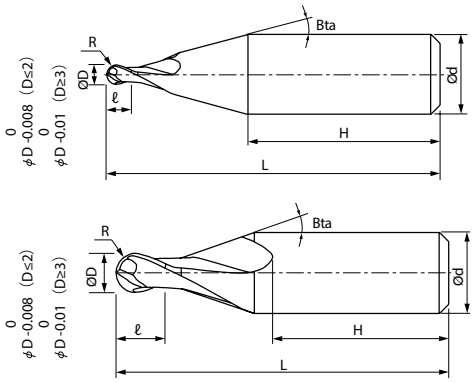
HSB-S / HSLB-S Tolerance

Radius of Ball Nose	Diameter Tolerance	Ball Radius Accuracy	Shank Diameter Tolerance
R0.1 ~ R1	**0/-0.008**	**± 0.003**	**0/-0.004 (h4)**
R1.5 ~ R2	**0/-0.01**		
R3		± 0.005	

Shank diameter tolerance h4!

Short overhang length with short shank length!





The shank taper angle and the shank length (H) shown are not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 10 models **Unit（mm）**

Model Number	Radius of Ball Nose R	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Shank Length H
HSB 2002-0020S	R0.1	0.2	16°	35	4	26.0
HSB 2003-0030S	R0.15	0.3	16°	35	4	26.0
HSB 2004-0040S	R0.2	0.4	16°	35	4	26.0
HSB 2006-0060S	R0.3	0.6	16°	35	4	26.0
HSB 2008-0080S	R0.4	0.8	16°	35	4	26.5
HSB 2010-0100S	R0.5	1	16°	35	4	26.5
HSB 2015-0150S	R0.75	1.5	16°	35	4	26.5
HSB 2020-0200S	R1	2	16°	35	4	25.5
HSB 2030-0300S	R1.5	3	16°	40	6	27.0
HSB 2040-0400S	R2	4	16°	40	6	26.0

Size **R0.1~R1**

CBN-LBF

CBN | 0° | R ±0.003 | Shank Dia 0/-0.004

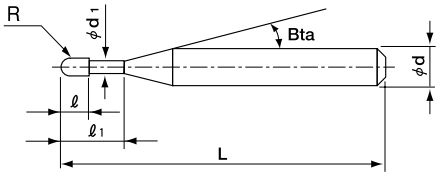
Additional 10 models

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

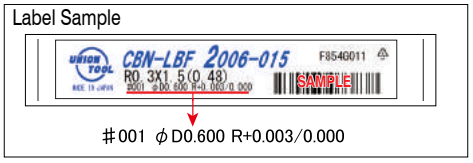
Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
		○	◎	◎	◎ ~68HRC										

Features

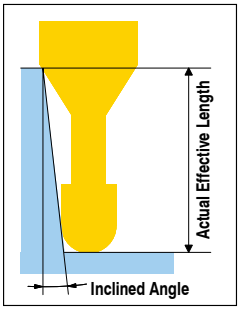
Optimized CBN material for milling ultra-hard materials and cutting edge geometry offer highly precision milling and long tool life.
Excellent wear resistance and chipping resistance maintain outstanding surface roughness and precision under long cycle time.
High precision shank diameter tolerance, 0/-0.004 mm.
CBN-LBF : Ball radius accuracy ± 0.003 mm based on Nominal Radius.
Based on Nominal Radius : Directly input the catalogue ball radius rate into the CAM for higher precision milling.



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.



Diameter and Ball Radius accuracy measurments are printed on the label to support High Precision milling.



Total 50 models ***Shank taper angle Bta is only for reference.** Unit (mm)

	Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød 1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles 30'	1°	1°30'	2°	3°
※	CBN-LBF 2002-003	R0.1	0.3	0.16	0.19	15°	50	4	0.30	0.30	0.31	0.32	0.34
	CBN-LBF 2002-006		0.6				50	4	0.60	0.61	0.63	0.65	0.70
	CBN-LBF 2002-010		1				50	4	1.01	1.04	1.07	1.11	1.19
	CBN-LBF 2003-005	R0.15	0.5	0.24	0.28	15°	50	4	0.51	0.53	0.54	0.56	0.60
	CBN-LBF 2003-0075		0.75				50	4	0.77	0.79	0.82	0.85	0.91
	CBN-LBF 2003-009		0.9				50	4	0.91	0.94	0.96	1.00	1.06
	CBN-LBF 2003-015		1.5				50	4	1.53	1.58	1.63	1.68	1.80

※Additional model

Next Page ➡

Unit（mm）

	Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød 1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
									30'	1°	1°30'	2°	3°
※	CBN-LBF 2004-005	R0.2	0.5	0.32	0.38	15°	50	4	0.51	0.52	0.54	0.55	0.58
※	CBN-LBF 2004-0075		0.75				50	4	0.77	0.79	0.81	0.84	0.90
※	CBN-LBF 2004-010		1				50	4	1.03	1.06	1.09	1.13	1.21
	CBN-LBF 2004-012		1.2				50	4	1.22	1.25	1.29	1.33	1.42
	CBN-LBF 2004-020		2				50	4	2.04	2.10	2.17	2.24	2.40
	CBN-LBF 2004-030		3				50	4	3.07	3.17	3.27	3.38	3.62
※	CBN-LBF 2005-010	R0.25	1	0.4	0.48	15°	50	4	1.02	1.05	1.08	1.12	1.19
	CBN-LBF 2005-015		1.5				50	4	1.53	1.57	1.62	1.66	1.78
	CBN-LBF 2005-025		2.5				50	4	2.56	2.63	2.72	2.80	3.00
	CBN-LBF 2005-035		3.5				50	4	3.59	3.70	3.82	3.94	4.22
※	CBN-LBF 2006-010	R0.3	1	0.48	0.58	15°	50	4	1.02	1.05	1.08	1.11	1.18
	CBN-LBF 2006-015		1.5				50	4	1.52	1.57	1.61	1.66	1.76
	CBN-LBF 2006-030		3				50	4	3.07	3.16	3.26	3.37	3.60
	CBN-LBF 2006-040		4				50	4	4.10	4.23	4.36	4.50	4.82
	CBN-LBF 2006-050		5				50	4	5.13	5.29	5.46	5.64	6.05
	CBN-LBF 2006-060		6				50	4	6.17	6.36	6.56	6.78	7.27
	CBN-LBF 2008-020	R0.4	2	0.6	0.78	15°	50	4	2.04	2.09	2.15	2.21	2.35
	CBN-LBF 2008-040		4				50	4	4.10	4.22	4.35	4.49	4.80
	CBN-LBF 2008-060		6				50	4	6.16	6.35	6.55	6.77	7.25
※	CBN-LBF 2010-015	R0.5	1.5	0.7	0.98	15°	50	4	1.53	1.57	1.61	1.66	1.76
※	CBN-LBF 2010-020		2				50	4	2.05	2.11	2.17	2.23	2.38
	CBN-LBF 2010-025		2.5				50	4	2.56	2.63	2.70	2.78	2.96
	CBN-LBF 2010-040		4				50	4	4.11	4.23	4.35	4.49	4.79
	CBN-LBF 2010-050		5				50	4	5.14	5.29	5.45	5.63	6.02
	CBN-LBF 2010-060		6				50	4	6.17	6.36	6.55	6.77	7.24
	CBN-LBF 2010-080		8				50	4	8.23	8.49	8.76	9.04	9.69
	CBN-LBF 2010-100		10				50	4	10.30	10.62	10.96	11.32	12.13
	CBN-LBF 2012-024	R0.6	2.4	0.8	1.18	15°	50	4	2.46	2.53	2.60	2.68	2.85
	CBN-LBF 2012-030		3				50	4	3.08	3.17	3.27	3.37	3.60
	CBN-LBF 2012-060		6				50	4	6.18	6.38	6.59	6.82	7.33
	CBN-LBF 2015-030	R0.75	3	0.9	1.46	15°	50	4	3.12	3.20	3.29	3.39	3.61
	CBN-LBF 2015-040		4				50	4	4.15	4.27	4.40	4.54	4.85
	CBN-LBF 2015-060		6				50	4	6.22	6.41	6.62	6.84	7.34
	CBN-LBF 2015-080		8				50	4	8.28	8.55	8.83	9.14	9.83
	CBN-LBF 2015-100		10				50	4	10.35	10.69	11.05	11.44	12.31
	CBN-LBF 2015-150		15				50	4	15.52	16.04	16.59	17.19	18.53
	CBN-LBF 2020-040	R1	4	1.2	1.97	15°	50	4	4.12	4.23	4.35	4.48	4.77
	CBN-LBF 2020-050		5				50	4	5.16	5.30	5.46	5.63	6.01
	CBN-LBF 2020-060		6				50	4	6.19	6.37	6.57	6.78	7.26
	CBN-LBF 2020-080		8				50	4	8.26	8.51	8.79	9.08	9.74
	CBN-LBF 2020-100		10				50	4	10.32	10.65	11.00	11.38	12.23
	CBN-LBF 2020-140		14				50	4	14.46	14.93	15.44	15.98	17.20
	CBN-LBF 2020-200		20				50	4	20.66	21.35	22.09	22.88	No Interference

※Additional model

Milling Conditions for CBN-LBF

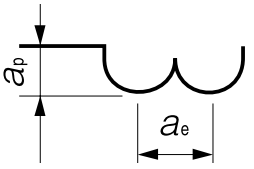
WORK MATERIAL			HEAT-TREATED STEELS / HARDENED STEELS STAVAX (~52HRC)				HARDENED STEELS SKD11 (~62HRC)				HARDENED STEELS HAP10 (~68HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2002-003	**R0.1**	0.3	30,000	660	0.005	0.005	30,000	550	0.005	0.005	30,000	440	0.005	0.005
2002-006		0.6	30,000	500	0.005	0.005	30,000	400	0.005	0.005	30,000	300	0.005	0.005
2002-010		1	30,000	290	0.005	0.005	30,000	200	0.005	0.005	30,000	120	0.005	0.005
2003-005	**R0.15**	0.5	30,000	1,000	0.005	0.005	30,000	950	0.005	0.005	30,000	620	0.005	0.005
2003-0075		0.75	30,000	850	0.005	0.005	30,000	800	0.005	0.005	30,000	500	0.005	0.005
2003-009		0.9	30,000	760	0.005	0.005	30,000	600	0.005	0.005	30,000	430	0.005	0.005
2003-015		1.5	30,000	460	0.005	0.005	30,000	320	0.005	0.005	30,000	190	0.005	0.005
2004-005	**R0.2**	0.5	30,000	1,580	0.005	0.01	30,000	1,330	0.005	0.01	30,000	860	0.005	0.005
2004-0075		0.75	30,000	1,390	0.005	0.01	30,000	1,140	0.005	0.01	30,000	800	0.005	0.005
2004-010		1	30,000	1,200	0.005	0.01	30,000	950	0.005	0.01	30,000	730	0.005	0.005
2004-012		1.2	30,000	1,050	0.005	0.01	30,000	800	0.005	0.01	30,000	620	0.005	0.005
2004-020		2	30,000	600	0.005	0.01	30,000	450	0.005	0.01	30,000	330	0.005	0.005
2004-030		3	20,000	400	0.005	0.005	20,000	300	0.005	0.005	20,000	190	0.003	0.003
2005-010	**R0.25**	1	30,000	1,600	0.01	0.01	30,000	1,300	0.01	0.01	30,000	920	0.005	0.01
2005-015		1.5	30,000	1,300	0.01	0.01	30,000	1,000	0.01	0.01	30,000	760	0.005	0.01
2005-025		2.5	30,000	800	0.01	0.01	30,000	700	0.01	0.01	30,000	480	0.005	0.01
2005-035		3.5	22,000	550	0.01	0.01	22,000	500	0.005	0.01	22,000	330	0.005	0.005
2006-010	**R0.3**	1	30,000	2,400	0.02	0.03	30,000	1,900	0.02	0.03	30,000	1,080	0.01	0.02
2006-015		1.5	30,000	2,000	0.02	0.03	30,000	1,500	0.02	0.03	30,000	1,000	0.01	0.02
2006-030		3	26,000	1,100	0.02	0.02	26,000	900	0.02	0.02	26,000	760	0.01	0.01
2006-040		4	22,000	750	0.01	0.02	22,000	650	0.01	0.02	22,000	570	0.005	0.01
2006-050		5	18,000	550	0.01	0.01	18,000	450	0.01	0.01	18,000	410	0.005	0.005
2006-060		6	12,000	350	0.005	0.01	12,000	290	0.005	0.005	12,000	260	0.003	0.003
2008-020	**R0.4**	2	30,000	2,500	0.02	0.03	30,000	2,100	0.02	0.03	30,000	1,700	0.01	0.02
2008-040		4	25,000	1,500	0.02	0.02	25,000	1,350	0.02	0.02	25,000	1,200	0.01	0.01
2008-060		6	18,000	1,000	0.01	0.02	18,000	800	0.01	0.02	18,000	750	0.005	0.01
2010-015	**R0.5**	1.5	30,000	3,700	0.04	0.05	30,000	3,400	0.03	0.04	30,000	2,300	0.025	0.03
2010-020		2	30,000	3,500	0.04	0.04	30,000	3,200	0.03	0.04	30,000	2,200	0.02	0.03
2010-025		2.5	30,000	3,300	0.04	0.04	30,000	3,000	0.03	0.04	30,000	2,100	0.02	0.03
2010-040		4	27,000	2,700	0.03	0.04	27,000	2,300	0.03	0.03	27,000	1,800	0.02	0.02
2010-050		5	23,000	2,200	0.03	0.03	23,000	1,800	0.03	0.03	23,000	1,450	0.02	0.02
2010-060		6	20,000	1,900	0.02	0.03	20,000	1,500	0.02	0.03	20,000	1,200	0.01	0.02
2010-080		8	14,000	1,300	0.01	0.02	14,000	1,000	0.01	0.02	14,000	800	0.01	0.01
2010-100		10	9,000	800	0.01	0.02	9,000	600	0.01	0.01	9,000	490	0.005	0.005

Milling Conditions for CBN-LBF

WORK MATERIAL			HEAT-TREATED STEELS / HARDENED STEELS STAVAX (~52HRC)				HARDENED STEELS SKD11 (~62HRC)				HARDENED STEELS HAP10 (~68HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2012-024	**R0.6**	2.4	30,000	3,000	0.05	0.05	29,500	2,550	0.035	0.04	29,000	2,100	0.02	0.03
2012-030		3	30,000	2,750	0.05	0.05	29,000	2,350	0.035	0.035	28,000	2,000	0.02	0.025
2012-060		6	23,500	2,000	0.03	0.03	23,500	1,650	0.025	0.025	23,500	1,300	0.02	0.02
2015-030	**R0.75**	3	30,000	3,000	0.07	0.07	28,500	2,550	0.045	0.05	27,000	2,100	0.02	0.03
2015-040		4	28,500	2,750	0.06	0.06	27,250	2,300	0.04	0.04	26,000	1,900	0.02	0.025
2015-060		6	26,000	2,200	0.04	0.045	25,500	1,900	0.03	0.03	25,000	1,650	0.02	0.02
2015-080		8	24,000	2,000	0.025	0.03	24,000	1,700	0.02	0.025	24,000	1,400	0.015	0.02
2015-100		10	16,000	1,300	0.02	0.02	16,000	1,100	0.015	0.018	16,000	900	0.01	0.015
2015-150		15	6,000	600	0.01	0.015	6,000	550	0.008	0.012	6,000	490	0.005	0.008
2020-040	**R1**	4	30,000	3,000	0.1	0.1	27,000	2,550	0.06	0.065	24,000	2,100	0.02	0.03
2020-050		5	28,000	2,750	0.08	0.08	26,000	2,300	0.05	0.05	24,000	1,900	0.02	0.025
2020-060		6	27,000	2,500	0.05	0.06	25,500	2,050	0.035	0.04	24,000	1,650	0.015	0.025
2020-080		8	25,000	2,200	0.035	0.045	24,500	1,800	0.025	0.03	24,000	1,400	0.015	0.02
2020-100		10	24,000	2,000	0.02	0.03	24,000	1,600	0.015	0.025	24,000	1,200	0.01	0.02
2020-140		14	15,000	1,250	0.015	0.02	15,000	1,050	0.012	0.018	15,000	850	0.008	0.015
2020-200		20	4,500	490	0.01	0.01	4,500	490	0.008	0.01	4,500	490	0.005	0.01

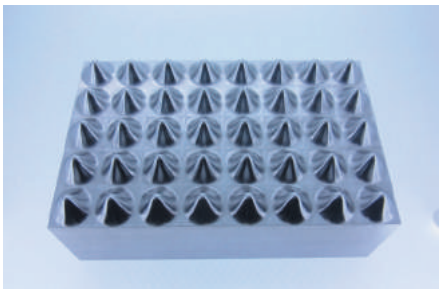
Note:
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
- Recommend oil mist to avoid tool damage.

a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

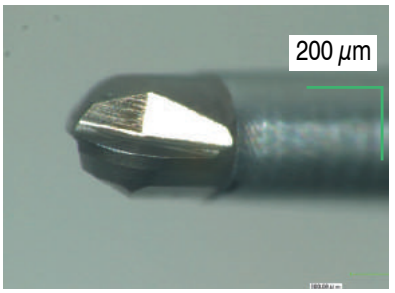


Milling example of convex shape for consecutive finishing CBN-LBF R0.3 × Effective Length 1.5

STAVAX (52HRC)

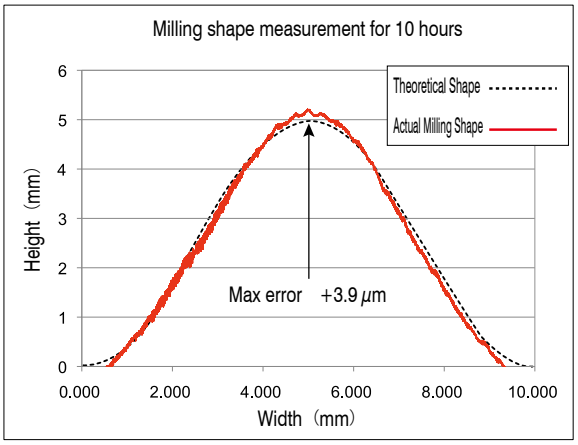


Work Size : 80 × 50 × 30 mm
Coolant : Oil Mist

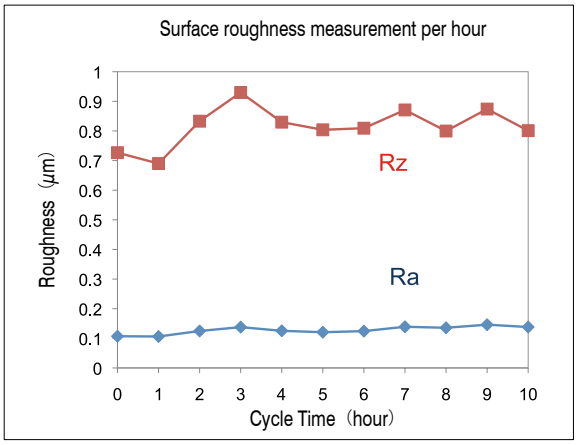


Tool damage after milling 10 hours.

No	Milling Process	Milling Method	Tool	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Cycle Time
1	Roughing	Contour milling	CFB 3030-0450 (R1.5 × Length of cut 4.5)	16,000	1,500	0.6	1.2	0:28:44
2	Semi-finishing	Contour spiral milling	CFB 3030-0450 (R1.5 × Length of cut 4.5)	28,600	2,300	0.004 (Cusp Height)	0.15	0:35:48
3	Semi-finishing	Contour spiral milling	CSEB 2020-0300 (R1 × Length of cut 3)	16,000	1,300	0.004 (Cusp Height)	0.05	2:18:42
4	Semi-finishing	Contour spiral milling	CSELB 2006-010 (R0.3 × Effective Length 1)	30,000	1,300	0.001 (Cusp Height)	0.06	3:44:47
5	Finishing	Contour spiral milling	CBN-LBF 2006-015 (R0.3 × Effective Length 1.5)	30,000	800	0.0001 (Cusp Height)	0.015	9:48:02
							Total	16:56:03



Excellent finishing shape for 10 hours milling.

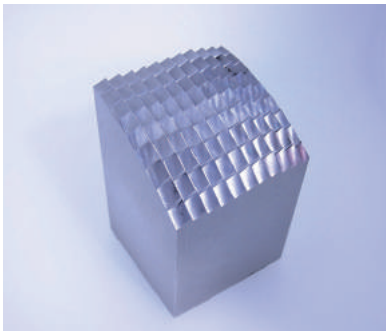


Constant surface roughness under long cycle time.

CBN-LBF Milling example of convex shape for consecutive finishing

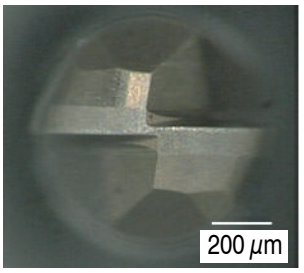
Finishing of reflector mold
CBN-LBF R0.4 × Effective Length 2

STAVAX（52HRC）



Work Size：35 × 35 × 50 mm
Coolant：Air Blow
（For finishing：Oil Mist）

Tool damage after milling 10 hours



Less tool damage and uniform milling surface

CBN-LBF
Milling video of reflector mold for finishing

No	Milling Process	Tool	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Axial Depth (mm)	Radial Depth (mm)	Cycle Time
1	Roughing	HRRS 4060-10-18S (⌀6 × CR1 × Effective Length 18)	3,500	2,500	0.2	2	0:18:00
2	Semi-roughing	HRRS 4060-10-18S (⌀6 × CR1 × Effective Length 18)	9,000	2,500	0.05	0.1	0:13:35
3	Semi-roughing	HRRS 4020-03-06S (⌀2 × CR0.3 × Effective Length 6)	3,500	1,000	0.04	1	0:33:55
4	Semi-finishing	HSB 2030-0800 (R1.5 × Length of Cut 8)	12,000	2,500	0.02	0.07	0:12:24
5	Semi-finishing	HSB 2015-0200 (R0.75 × Length of Cut 2)	7,000	1,000	0.04	0.07	0:20:50
6	Semi-finishing	HSB 2015-0200 (R0.75 × Length of Cut 2)	7,000	700	0.05	0.05	0:18:08
7	Semi-finishing	HSB 2010-0250 (R0.5 × Length of Cut 2.5)	8,000	500	0.02	0.03	0:23:24
8	Semi-finishing	HSB 2010-0250 (R0.5 × Length of Cut 2.5)	15,000	1,200	0.02	0.03	1:30:33
9	Finishing	CBN-LBF 2008-020 (R0.4 × Effective Length 2)	26,000	800	0.01	0.004	10:12:54
						Total	14:03:43

Size **R0.1~R1**

CBN-LBSF

CBN | 20° | R ±0.002 | Shank Dia 0/-0.004

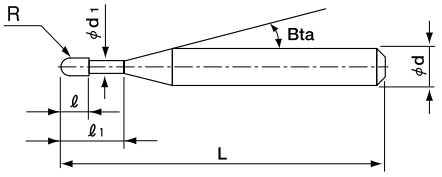
NEW

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
		○	◎	◎	◎ ~68HRC										

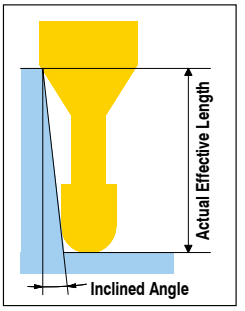
Features

Optimized CBN material for milling the ultra-hard materials, with excellent wear resistance and chipping resistance offers long tool life.
Improved milling surface by the original flute design.
For higher precision and better surface finish.
Highly precision shank diameter tolerance, 0/-0.004 mm.
Ball radius accuracy ± 0.002 mm based on Nominal Radius.
Based on Nominal Radius : Directly input the catalogue ball radius rate into the CAM for higher precision milling.



Ball Radius accuracy measurments are printed on the label to support High Precision milling.

The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.



Total 24 models ***Shank taper angle Bta is only for reference.** **Unit（mm）**

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød 1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles 30'	1°	1°30'	2°	3°
CBN-LBSF 2002-003	R0.1	0.3	0.13	0.19	15°	50	4	0.30	0.30	0.30	0.30	0.32
CBN-LBSF 2002-006		0.6				50	4	0.60	0.60	0.62	0.64	0.69
CBN-LBSF 2003-005	R0.15	0.5	0.22	0.28	15°	50	4	0.51	0.53	0.54	0.56	0.60
CBN-LBSF 2003-0075		0.75				50	4	0.77	0.79	0.82	0.85	0.91
CBN-LBSF 2003-009		0.9				50	4	0.91	0.94	0.97	1.01	1.08
CBN-LBSF 2004-0075	R0.2	0.75	0.32	0.38	15°	50	4	0.77	0.79	0.81	0.84	0.90
CBN-LBSF 2004-010		1				50	4	1.03	1.06	1.09	1.13	1.21
CBN-LBSF 2004-012		1.2				50	4	1.22	1.26	1.30	1.35	1.44

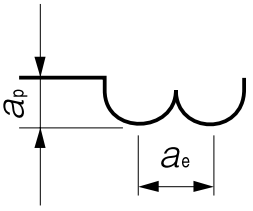
Next Page ➡

Unit（mm）

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød 1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
CBN-LBSF 2005-010	R0.25	1	0.4	0.48	15°	50	4	1.01	1.04	1.07	1.11	1.18
CBN-LBSF 2005-015		1.5				50	4	1.53	1.58	1.63	1.68	1.80
CBN-LBSF 2006-010	R0.3	1	0.48	0.58	15°	50	4	1.01	1.04	1.07	1.10	1.17
CBN-LBSF 2006-015		1.5				50	4	1.53	1.57	1.62	1.68	1.79
CBN-LBSF 2006-020		2				50	4	2.05	2.11	2.18	2.25	2.41
CBN-LBSF 2010-015	R0.5	1.5	0.7	0.98	15°	50	4	1.53	1.57	1.61	1.66	1.76
CBN-LBSF 2010-020		2				50	4	2.05	2.11	2.17	2.23	2.38
CBN-LBSF 2010-025		2.5				50	4	2.57	2.64	2.72	2.81	3.00
CBN-LBSF 2010-030		3				50	4	3.09	3.18	3.28	3.38	3.62
CBN-LBSF 2015-025	R0.75	2.5	0.9	1.46	15°	50	4	2.60	2.67	2.74	2.81	2.99
CBN-LBSF 2015-030		3				50	4	3.12	3.20	3.29	3.39	3.61
CBN-LBSF 2015-038		3.8				50	4	3.94	4.06	4.18	4.31	4.61
CBN-LBSF 2020-030	R1	3	1.2	1.97	15°	50	4	3.09	3.16	3.24	3.33	3.53
CBN-LBSF 2020-040		4				50	4	4.12	4.23	4.35	4.48	4.77
CBN-LBSF 2020-050		5				50	4	5.16	5.30	5.46	5.63	6.01
CBN-LBSF 2020-060		6				50	4	6.19	6.37	6.57	6.78	7.26

Milling Conditions for CBN-LBSF

WORK MATERIAL			HEAT-TREATED STEELS / HARDENED STEELS STAVAX・ELMAX・HAP10 (～68HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2002-003	**R0.1**	0.3	30,000	240	0.005 MAX	0.01 MAX
2002-006		0.6	30,000	200	0.005 MAX	0.01 MAX
2003-005	**R0.15**	0.5	30,000	300	0.005 MAX	0.01 MAX
2003-0075		0.75	30,000	250	0.005 MAX	0.01 MAX
2003-009		0.9	30,000	250	0.005 MAX	0.01 MAX
2004-0075	**R0.2**	0.75	30,000	360	0.005 MAX	0.01 MAX
2004-010		1	30,000	300	0.005 MAX	0.01 MAX
2004-012		1.2	30,000	300	0.005 MAX	0.01 MAX
2005-010	**R0.25**	1	30,000	420	0.005 MAX	0.01 MAX
2005-015		1.5	30,000	350	0.005 MAX	0.01 MAX
2006-010	**R0.3**	1	30,000	500	0.01 MAX	0.015 MAX
2006-015		1.5	30,000	500	0.01 MAX	0.015 MAX
2006-020		2	30,000	350	0.01 MAX	0.015 MAX
2010-015	**R0.5**	1.5	30,000	750	0.01 MAX	0.02 MAX
2010-020		2	30,000	750	0.01 MAX	0.02 MAX
2010-025		2.5	30,000	750	0.01 MAX	0.02 MAX
2010-030		3	30,000	500	0.01 MAX	0.02 MAX
2015-025	**R0.75**	2.5	20,000	750	0.01 MAX	0.02 MAX
2015-030		3	20,000	750	0.01 MAX	0.02 MAX
2015-038		3.8	20,000	750	0.01 MAX	0.02 MAX
2020-030	**R1**	3	15,000	750	0.01 MAX	0.025 MAX
2020-040		4	15,000	750	0.01 MAX	0.025 MAX
2020-050		5	15,000	750	0.01 MAX	0.025 MAX
2020-060		6	15,000	500	0.01 MAX	0.025 MAX

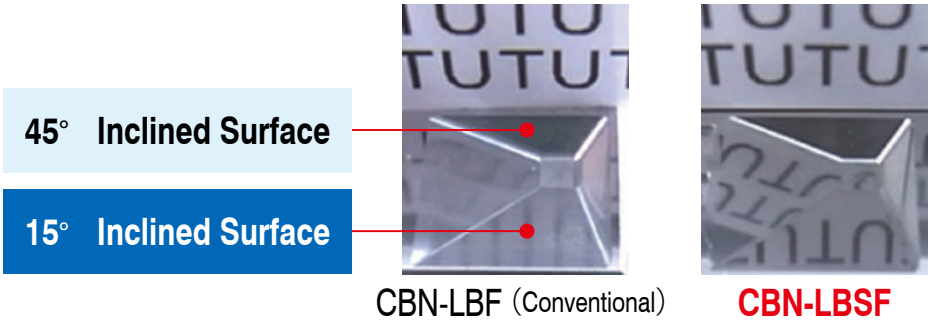


a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machines maximum spindle speed.
・Recommend oil mist to avoid tool damage.

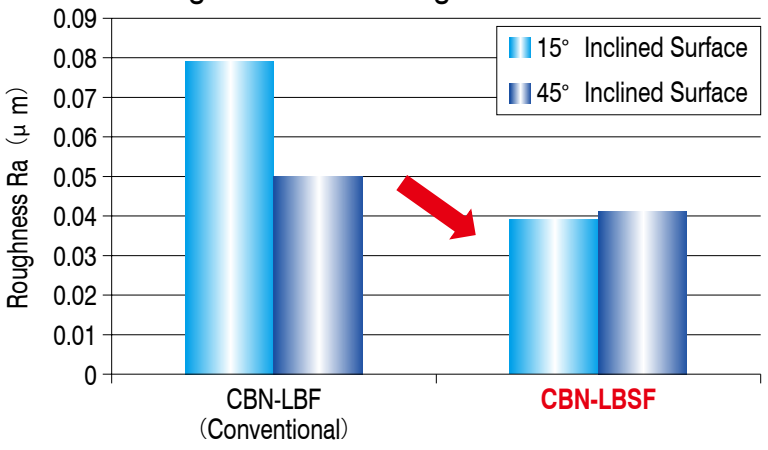
Milling Example of Inclined Surface
CBN-LBSF R0.3 × Effective Length 1.5

ELMAX（60.5HRC）



Work Size：9 × 9 × Depth 1.5 mm
Coolant：Oil Mist

Surface roughness after milling



Tool	CBN-LBSF 2006-015
Process	Finishing
Milling Method	Contour spiral milling
Spindle Speed	30,000 min^{-1}
Feed Rate	550 mm/min
Finishing allowance	0.005 mm
Cusp Height	0.0001 mm
Cycle Time	21.5 min

Greatly improved surface finish compared with the conventional CBN-LBF series.

Size R0.3~R3

CFLB

Super MG | UT COAT | 30° | R ±0.005 (R0.3~R1.5) | R ±0.007 (R2~R3) | Shank Dia 0/-0.005 | Variable Pitch

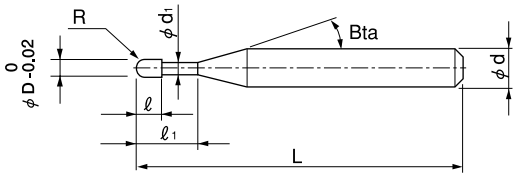
Additional 15 models

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	◎			○	◎		◎	○		◎	◎		

Features

3 flute design that offers higher feed rate milling when compared to a similar specification 2 flute end mill.
UTCOAT offers excellent lubricity and longer tool life.
Variable pitch design minimizes tool chatter and enables high-precision mold milling.
The 3 slots at the tip offers chip evacuation and improved surface finish. (Except R.0.075 or below)
Diameter Tolerance: 0/-0.02



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 47 models

Unit (mm)

	Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles 30'	1°	1°30'	2°	3°
	CFLB 3006-020	R0.3	2	0.48	0.58	16°	50	4	2.16	2.23	2.30	2.37	2.53
	CFLB 3006-030		3				50	4	3.20	3.30	3.40	3.51	3.76
	CFLB 3006-040		4				50	4	4.23	4.36	4.50	4.65	4.98
※	CFLB 3006-060		6				50	4	6.30	6.49	6.70	6.93	7.43
※	CFLB 3008-040	R0.4	4	0.64	0.78	16°	50	4	4.23	4.36	4.49	4.64	4.96
※	CFLB 3008-060		6				50	4	6.29	6.49	6.69	6.91	7.41
※	CFLB 3008-080		8				50	4	8.36	8.62	8.89	9.19	9.85
	CFLB 3010-025	R0.5	2.5	0.8	0.96	16°	50	4	2.71	2.79	2.87	2.95	3.14
	CFLB 3010-030		3				50	4	3.23	3.32	3.42	3.52	3.75
	CFLB 3010-040		4				50	4	4.26	4.38	4.52	4.66	4.98
	CFLB 3010-050		5				50	4	5.29	5.45	5.62	5.80	6.20
	CFLB 3010-060		6				50	4	6.32	6.51	6.72	6.94	7.42
	CFLB 3010-080		8				50	4	8.39	8.64	8.92	9.21	9.87
※	CFLB 3010-100		10				50	4	10.45	10.77	11.12	11.49	12.32
※	CFLB 3010-120		12				50	4	12.51	12.90	13.32	13.77	14.76

※Additional model

Next Page ➡

Unit（mm）

	Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
									30'	1°	1°30'	2°	3°
※	CFLB 3015-040	R0.75	4	1.2	1.43	16°	50	4	4.18	4.29	4.41	4.54	4.83
	CFLB 3015-060		6				50	4	6.24	6.42	6.61	6.82	7.28
	CFLB 3015-080		8				50	4	8.30	8.55	8.82	9.10	9.73
	CFLB 3015-100		10				50	4	10.37	10.68	11.02	11.38	12.18
※	CFLB 3015-120		12				50	4	12.43	12.81	13.22	13.65	14.62
※	CFLB 3015-160		16				50	4	16.56	17.07	17.62	18.21	19.52
※	CFLB 3020-040	R1	4	1.6	1.83	16°	50	4	4.35	4.46	4.58	4.71	4.99
	CFLB 3020-060		6				50	4	6.41	6.59	6.78	6.99	7.44
	CFLB 3020-080		8				50	4	8.48	8.72	8.98	9.26	9.89
	CFLB 3020-100		10				50	4	10.54	10.85	11.18	11.54	12.33
	CFLB 3020-120		12				50	4	12.60	12.98	13.38	13.82	14.78
	CFLB 3020-140		14				50	4	14.66	15.11	15.59	16.09	17.23
	CFLB 3020-160		16				50	4	16.73	17.24	17.79	18.37	19.68
※	CFLB 3020-180		18				55	4	18.79	19.37	19.99	20.65	No Interference
※	CFLB 3020-200		20				55	4	20.85	21.50	22.19	22.93	No Interference
	CFLB 3030-080	R1.5	8	2.4	2.73	16°	60	6	8.64	8.87	9.13	9.39	9.99
	CFLB 3030-100		10				60	6	10.70	11.00	11.33	11.67	12.44
	CFLB 3030-120		12				60	6	12.77	13.14	13.53	13.96	14.89
	CFLB 3030-160		16				60	6	16.89	17.39	17.93	18.50	19.78
	CFLB 3030-200		20				70	6	21.02	21.65	22.33	23.06	24.68
	CFLB 3030-250		25				70	6	26.17	26.98	27.83	28.75	No Interference
※	CFLB 3040-100	R2	10	3.2	3.63	16°	70	6	10.87	11.16	11.47	11.80	12.54
	CFLB 3040-120		12				70	6	12.93	13.29	13.67	14.08	14.99
	CFLB 3040-160		16				70	6	17.06	17.55	18.07	18.63	19.89
	CFLB 3040-200		20				70	6	21.18	21.81	22.47	23.19	No Interference
	CFLB 3040-250		25				70	6	26.34	27.13	27.98	28.88	No Interference
	CFLB 3040-300		30				70	6	31.50	32.45	33.48	No Interference	No Interference
	CFLB 3060-200	R3	20	4.8	5.42	-	80	6	No Interference	No Interference	No Interference	No Interference	No Interference
※	CFLB 3060-250		25				80	6	No Interference	No Interference	No Interference	No Interference	No Interference
	CFLB 3060-300		30				80	6	No Interference	No Interference	No Interference	No Interference	No Interference
※	CFLB 3060-350		35				80	6	No Interference	No Interference	No Interference	No Interference	No Interference
	CFLB 3060-400		40				90	6	No Interference	No Interference	No Interference	No Interference	No Interference

※Additional model

Next Page ➡

Milling Conditions for CFLB

WORK MATERIAL			COPPER ALUMINUM ALLOYS C1100 / A5052 / A7075 etc.				CARBON STEELS / ALLOY STEELS / HARDENED STEELS S50C / NAK80 etc.				HARDENED STEELS STAVAX / SKD61 etc. (～55HRC)			
Coolant			WET				WET／DRY				WET／DRY			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
3006-020	**R0.3**	2	30,000	1,000	0.030	0.130	30,000	1,000	0.030	0.130	30,000	700	0.030	0.130
3006-030		3	30,000	1,000	0.030	0.130	30,000	1,000	0.030	0.130	30,000	700	0.030	0.130
3006-040		4	30,000	700	0.020	0.100	30,000	700	0.020	0.100	30,000	480	0.020	0.100
3006-060		6	30,000	475	0.010	0.050	30,000	475	0.010	0.050	30,000	300	0.010	0.050
3008-040	**R0.4**	4	30,000	1,250	0.040	0.170	30,000	1,250	0.040	0.170	30,000	850	0.040	0.170
3008-060		6	30,000	1,000	0.030	0.140	30,000	1,000	0.030	0.140	30,000	680	0.030	0.140
3008-080		8	27,000	770	0.018	0.120	27,000	770	0.018	0.120	27,000	510	0.018	0.120
3010-025	**R0.5**	2.5	30,000	1,500	0.050	0.210	30,000	1,500	0.050	0.210	30,000	1,000	0.050	0.210
3010-030		3	30,000	1,500	0.050	0.210	30,000	1,500	0.050	0.210	30,000	1,000	0.050	0.210
3010-040		4	30,000	1,500	0.050	0.210	30,000	1,500	0.050	0.210	30,000	1,000	0.050	0.210
3010-050		5	30,000	1,500	0.050	0.210	30,000	1,500	0.050	0.210	30,000	1,000	0.050	0.210
3010-060		6	30,000	1,500	0.040	0.190	30,000	1,500	0.040	0.190	30,000	1,000	0.040	0.190
3010-080		8	25,200	1,200	0.030	0.170	25,200	1,200	0.030	0.170	25,200	800	0.030	0.170
3010-100		10	24,100	930	0.023	0.150	24,100	930	0.023	0.150	24,100	620	0.023	0.155
3010-120		12	23,000	660	0.017	0.135	23,000	660	0.017	0.135	23,000	440	0.017	0.135
3015-040	**R0.75**	4	30,000	2,500	0.075	0.320	30,000	2,500	0.075	0.320	30,000	1,700	0.075	0.320
3015-060		6	30,000	2,500	0.075	0.320	30,000	2,500	0.075	0.320	30,000	1,700	0.075	0.320
3015-080		8	30,000	2,500	0.075	0.320	30,000	2,500	0.075	0.320	30,000	1,700	0.075	0.320
3015-100		10	24,000	2,000	0.050	0.260	24,000	2,000	0.050	0.260	24,000	1,350	0.050	0.260
3015-120		12	20,800	1,400	0.035	0.250	20,800	1,400	0.035	0.250	20,800	925	0.035	0.230
3015-160		16	17,500	800	0.025	0.240	17,500	800	0.025	0.240	17,500	500	0.017	0.200
3020-040	**R1**	4	30,000	3,200	0.200	0.600	30,000	3,200	0.200	0.600	30,000	2,500	0.200	0.600
3020-060		6	30,000	3,200	0.200	0.600	30,000	3,200	0.200	0.600	30,000	2,500	0.200	0.600
3020-080		8	30,000	3,200	0.200	0.600	30,000	3,200	0.200	0.600	29,150	2,400	0.200	0.600
3020-100		10	27,000	3,000	0.200	0.600	27,000	3,000	0.200	0.600	24,300	2,000	0.200	0.600
3020-120		12	21,600	2,400	0.150	0.500	21,600	2,400	0.150	0.500	21,000	1,600	0.140	0.500
3020-140		14	16,200	1,600	0.120	0.450	16,200	1,600	0.120	0.450	16,200	1,200	0.080	0.350
3020-160		16	12,600	1,200	0.100	0.400	12,600	1,200	0.100	0.400	12,600	1,200	0.050	0.300
3020-180		18	12,350	1,060	0.070	0.375	12,350	1,060	0.070	0.375	12,350	900	0.035	0.285
3020-200		20	12,050	930	0.040	0.350	12,050	930	0.040	0.350	12,050	600	0.017	0.270
3030-080	**R1.5**	8	24,000	4,000	0.300	0.900	24,000	4,000	0.300	0.900	21,600	2,700	0.300	0.900
3030-100		10	24,000	4,000	0.300	0.900	24,000	4,000	0.300	0.900	21,600	2,700	0.300	0.900
3030-120		12	24,000	3,600	0.300	0.900	24,000	3,600	0.300	0.900	21,600	2,450	0.300	0.900
3030-160		16	16,800	2,800	0.270	0.850	16,800	2,800	0.270	0.850	15,100	1,900	0.270	0.850
3030-200		20	12,000	2,000	0.240	0.750	12,000	2,000	0.240	0.750	10,800	1,350	0.240	0.750
3030-250		25	8,400	1,200	0.150	0.650	8,400	1,200	0.150	0.650	7,500	800	0.150	0.650

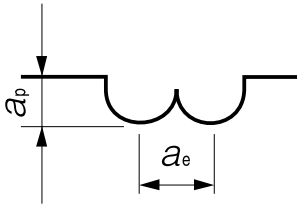
Milling Conditions for CFLB

WORK MATERIAL			TITANIUM ALLOYS STAINLESS STEELS Ti-6Al-4V / SUS etc.				HEAT RESISTANT ALLOYS (Inconel718)			
Coolant			WET				WET			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
3006-020	**R0.3**	2	20,000	1,000	0.015	0.090	9,000	225	0.015	0.090
3006-030		3	20,000	1,000	0.015	0.090	7,500	185	0.012	0.080
3006-040		4	20,000	700	0.010	0.070	4,500	100	0.010	0.070
3006-060		6	20,000	200	0.005	0.035	2,400	30	0.004	0.035
3008-040	**R0.4**	4	20,000	1,250	0.020	0.120	10,000	310	0.020	0.120
3008-060		6	20,000	950	0.013	0.075	7,200	200	0.013	0.075
3008-080		8	18,000	600	0.007	0.060	4,450	95	0.007	0.060
3010-025	**R0.5**	2.5	20,000	1,500	0.025	0.150	10,000	375	0.025	0.150
3010-030		3	20,000	1,500	0.025	0.150	10,000	375	0.025	0.150
3010-040		4	20,000	1,500	0.025	0.150	9,000	330	0.025	0.150
3010-050		5	20,000	1,500	0.025	0.150	7,500	280	0.020	0.140
3010-060		6	20,000	1,500	0.020	0.140	6,000	220	0.020	0.130
3010-080		8	16,800	1,200	0.015	0.120	3,500	110	0.015	0.110
3010-100		10	16,050	930	0.011	0.100	3,350	85	0.011	0.095
3010-120		12	15,300	660	0.008	0.095	3,200	60	0.008	0.085
3015-040	**R0.75**	4	20,000	2,500	0.035	0.220	9,000	380	0.030	0.220
3015-060		6	20,000	2,500	0.035	0.220	9,000	380	0.030	0.220
3015-080		8	20,000	2,500	0.035	0.220	6,000	250	0.025	0.180
3015-100		10	16,000	2,000	0.025	0.190	4,500	170	0.020	0.170
3015-120		12	14,000	1,370	0.020	0.180	4,100	135	0.017	0.170
3015-160		16	12,000	730	0.013	0.170	3,600	100	0.013	0.165
3020-040	**R1**	4	20,000	3,200	0.100	0.430	12,000	1,000	0.100	0.400
3020-060		6	20,000	3,200	0.100	0.430	12,000	1,000	0.100	0.400
3020-080		8	20,000	3,200	0.100	0.430	10,800	900	0.100	0.400
3020-100		10	18,000	3,000	0.100	0.430	9,000	750	0.080	0.360
3020-120		12	14,400	2,400	0.075	0.380	7,200	600	0.080	0.340
3020-140		14	10,800	1,600	0.060	0.340	5,400	400	0.070	0.320
3020-160		16	8,400	1,200	0.050	0.340	4,200	300	0.060	0.300
3020-180		18	8,250	1,000	0.035	0.260	4,100	250	0.035	0.260
3020-200		20	8,050	800	0.017	0.245	4,000	200	0.015	0.230
3030-080	**R1.5**	8	16,000	4,000	0.150	0.650	8,000	1,000	0.150	0.650
3030-100		10	16,000	4,000	0.150	0.650	7,200	900	0.150	0.650
3030-120		12	16,000	3,600	0.150	0.650	7,200	800	0.150	0.650
3030-160		16	11,200	2,800	0.135	0.620	4,800	600	0.120	0.550
3030-200		20	8,000	2,000	0.120	0.580	3,600	400	0.100	0.520
3030-250		25	5,600	1,200	0.075	0.460	2,800	300	0.090	0.480

Milling Conditions for CFLB

WORK MATERIAL			COPPER ALUMINUM ALLOYS C1100 / A5052 / A7075 etc.				CARBON STEELS / ALLOY STEELS / HARDENED STEELS S50C / NAK80 etc.				HARDENED STEELS STAVAX / SKD61 etc. (~55HRC)			
Coolant			WET				WET／DRY				WET／DRY			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
3040-100	R2	10	18,000	4,000	0.400	1.200	18,000	4,000	0.400	1.200	16,200	2,700	0.400	1.200
3040-120		12	18,000	4,000	0.400	1.200	18,000	4,000	0.400	1.200	16,200	2,700	0.400	1.200
3040-160		16	16,200	3,600	0.400	1.200	16,200	3,600	0.400	1.200	14,600	2,450	0.400	1.200
3040-200		20	13,500	3,000	0.400	1.200	13,500	3,000	0.400	1.200	12,200	2,000	0.400	1.200
3040-250		25	9,900	2,200	0.320	1.050	9,900	2,200	0.320	1.050	8,900	1,450	0.320	1.050
3040-300		30	7,200	1,400	0.200	0.850	7,200	1,400	0.200	0.850	6,500	950	0.200	0.850
3060-200	R3	20	12,000	4,000	0.600	1.800	12,000	4,000	0.600	1.800	10,800	2,700	0.600	1.800
3060-250		25	10,500	3,500	0.600	1.800	10,500	3,500	0.600	1.800	9,450	2,350	0.600	1.800
3060-300		30	9,000	3,000	0.600	1.800	9,000	3,000	0.600	1.800	8,100	2,000	0.600	1.800
3060-350		35	7,500	2,500	0.600	1.800	7,500	2,500	0.500	1.600	6,750	1,650	0.500	1.600
3060-400		40	6,000	2,000	0.400	1.400	6,000	2,000	0.400	1.400	5,400	1,350	0.400	1.400

a_p : Axial Depth (mm)
a_e : Radial Depth (mm)



Note:
・Decrease the feed rate more than 50% from the milling parameters when slot milling.
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when burr and red-hot occur.
・Recommend wet coolant for Copper.
・DRY: air blow, WET: water soluble or oil coolant.

Milling Conditions for CFLB

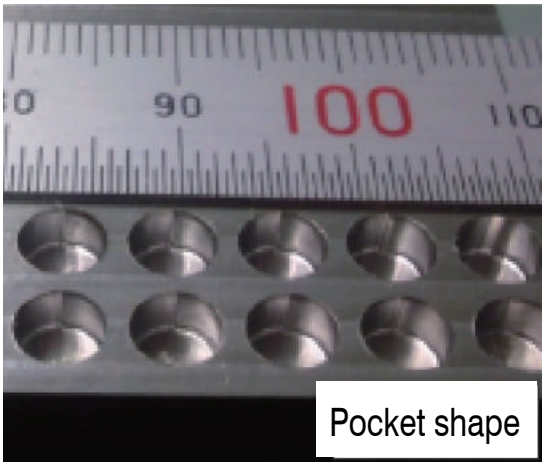
WORK MATERIAL			TITANIUM ALLOYS STAINLESS STEELS Ti-6Al-4V / SUS etc.				HEAT RESISTANT ALLOYS (Inconel718)			
Coolant			WET				WET			
Model Number	Outside Diameter (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
3040-100	R2	10	12,000	4,000	0.200	0.870	6,000	1,000	0.200	0.850
3040-120		12	12,000	4,000	0.200	0.870	6,000	1,000	0.200	0.850
3040-160		16	10,800	3,600	0.200	0.870	5,400	900	0.200	0.850
3040-200		20	9,000	3,000	0.200	0.870	4,500	750	0.170	0.760
3040-250		25	6,600	2,200	0.160	0.780	2,700	400	0.140	0.680
3040-300		30	4,800	1,400	0.100	0.620	2,100	300	0.120	0.630
3060-200	R3	20	8,000	4,000	0.300	1.300	3,600	900	0.300	1.300
3060-250		25	7,000	3,500	0.300	1.300	3,300	820	0.270	1.200
3060-300		30	6,000	3,000	0.300	1.300	3,000	750	0.250	1.170
3060-350		35	5,000	2,500	0.250	1.150	2,400	570	0.230	1.100
3060-400		40	4,000	2,000	0.200	1.050	1,800	400	0.210	1.040

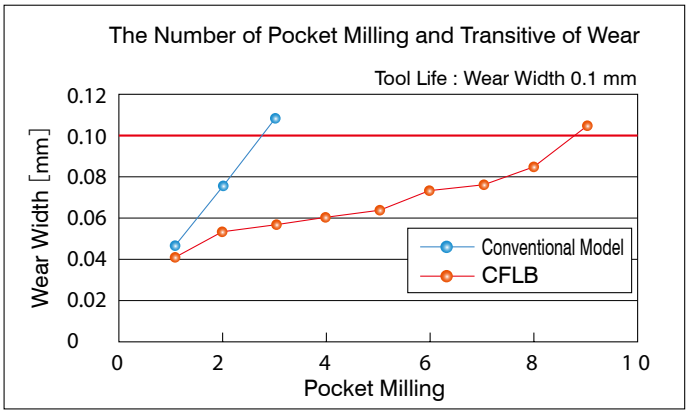
Tool Life Comparison with Conventional Model (2 flutes) R0.3 x Effective Length 3mm

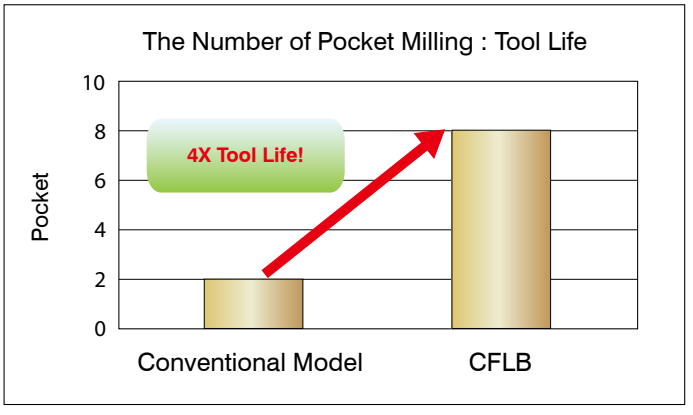
S50C Pocket Milling

■ Milling Conditions

Work Material	S50C
Spindle Speed	30,000 min^{-1}
Feed Rate	1,000 mm/min
Axial Depth a_p	0.03 mm
Radial Depth a_e	0.13 mm
Coolant	Air Blow (Through Spindle)
Overhang	12 mm
Pocket Size	Ø 5 × 3 mm
Cycle Time	14 min/pocket







Size **R0.05~R3**

CSELB

Super MG | UT COAT | Shank Dia 0/-0.005 | Back Taper Geometry

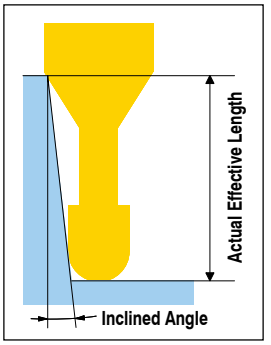
Additional 16 models

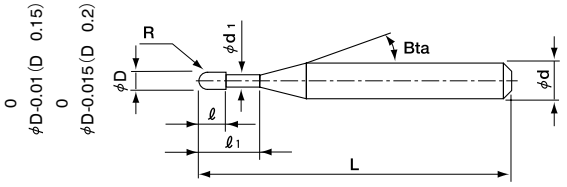
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	◎			○	◎		◎			○	○		

Features

New, robust geometry offers durability when roughing, yet gives excellent surface quality for finishing.
UTCOAT with improved hardness, durability, lubricity and adhesion offers better wear resistance and surface roughness.
Broad application range from raw materials to Hardened Steels (55HRC).





The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Radius of Ball Nose	Diameter Tolerance	Ballend Radius Tolerance	Helix Angle
R0.05 ~ R0.075	0/-0.01	R ±0.005	0°
R0.1 ~ R3	0/-0.015	R ±0.005	30°

Total 308 models

Unit (mm)

	Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles 30'	1°	1°30'	2°	3°
※	CSELB 2001-002	R0.05	0.2	0.08	0.095	11°	45	4	0.22	0.24	0.26	0.28	0.31
	CSELB 2001-003		0.3				45	4	0.33	0.35	0.38	0.40	0.45
	CSELB 2001-005		0.5				45	4	0.54	0.58	0.61	0.64	0.72
	CSELB 20015-003	R0.075	0.3	0.12	0.135	11°	45	4	0.36	0.38	0.40	0.42	0.48
	CSELB 20015-005		0.5				45	4	0.58	0.60	0.63	0.67	0.75
	CSELB 20015-010		1				45	4	1.10	1.15	1.21	1.28	1.43

※Additional model

Next Page ➡

Unit (mm)

	Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
									30'	1°	1°30'	2°	3°
	CSELB 2002-003	R0.1	0.3	0.16	0.19	11°	45	4	0.40	0.42	0.44	0.46	0.52
	CSELB 2002-005		0.5				45	4	0.61	0.64	0.67	0.71	0.79
	CSELB 2002-005-6		0.5				50	6	0.61	0.64	0.67	0.71	0.79
	CSELB 2002-0075		0.75				45	4	0.87	0.92	0.96	1.01	1.13
	CSELB 2002-010		1				45	4	1.14	1.19	1.25	1.32	1.48
	CSELB 2002-010-6		1				50	6	1.14	1.19	1.25	1.32	1.48
※	CSELB 2002-0125		1.25				45	4	1.39	1.45	1.53	1.61	1.80
	CSELB 2002-015		1.5				45	4	1.65	1.73	1.81	1.91	2.14
※	CSELB 2002-0175		1.75				45	4	1.91	2.00	2.10	2.22	2.49
	CSELB 2002-020		2				45	4	2.17	2.28	2.39	2.52	2.83
※	CSELB 2002-0225		2.25				45	4	2.43	2.55	2.68	2.83	3.17
	CSELB 2002-025		2.5				45	4	2.69	2.83	2.97	3.13	3.51
	CSELB 2002-030		3				45	4	3.22	3.37	3.55	3.74	4.20
	CSELB 2003-005	R0.15	0.5	0.24	0.29	11°	45	4	0.61	0.64	0.67	0.70	0.77
	CSELB 2003-006		0.6				45	4	0.71	0.75	0.78	0.82	0.91
	CSELB 2003-0075		0.75				45	4	0.87	0.91	0.95	1.00	1.12
	CSELB 2003-010		1				45	4	1.13	1.19	1.24	1.31	1.46
	CSELB 2003-010-6		1				50	6	1.13	1.19	1.24	1.31	1.46
※	CSELB 2003-0125		1.25				45	4	1.38	1.45	1.52	1.60	1.78
	CSELB 2003-015		1.5				45	4	1.64	1.72	1.81	1.90	2.12
	CSELB 2003-015-6		1.5				50	6	1.64	1.72	1.81	1.90	2.12
※	CSELB 2003-0175		1.75				45	4	1.91	2.00	2.10	2.21	2.47
	CSELB 2003-020		2				45	4	2.17	2.27	2.38	2.51	2.81
	CSELB 2003-020-6		2				50	6	2.17	2.27	2.38	2.51	2.81
※	CSELB 2003-0225		2.25				45	4	2.43	2.55	2.67	2.82	3.15
	CSELB 2003-025		2.5				45	4	2.69	2.82	2.96	3.12	3.49
	CSELB 2003-030		3				45	4	3.22	3.37	3.54	3.73	4.18
	CSELB 2003-040		4				45	4	4.26	4.47	4.70	4.95	5.55
	CSELB 2003-050		5				45	4	5.31	5.57	5.85	6.17	6.92
	CSELB 2004-005	R0.2	0.5	0.32	0.39	11°	45	4	0.61	0.63	0.66	0.69	0.76
	CSELB 2004-0075		0.75				45	4	0.87	0.91	0.95	0.99	1.10
	CSELB 2004-010		1				45	4	1.13	1.18	1.24	1.30	1.44
	CSELB 2004-010-6		1				50	6	1.13	1.18	1.24	1.30	1.44
※	CSELB 2004-0125		1.25				45	4	1.38	1.44	1.51	1.59	1.76
	CSELB 2004-015		1.5				45	4	1.64	1.72	1.80	1.89	2.11
	CSELB 2004-015-6		1.5				50	6	1.64	1.72	1.80	1.89	2.11
※	CSELB 2004-0175		1.75				45	4	1.90	1.99	2.09	2.19	2.45
	CSELB 2004-020		2				45	4	2.17	2.27	2.38	2.50	2.79
	CSELB 2004-020-6		2				50	6	2.17	2.27	2.38	2.50	2.79
※	CSELB 2004-0225		2.25				45	4	2.43	2.54	2.67	2.80	3.13
	CSELB 2004-025		2.5				45	4	2.69	2.82	2.95	3.11	3.48
	CSELB 2004-025-6		2.5				50	6	2.69	2.82	2.95	3.11	3.48
	CSELB 2004-030		3				45	4	3.21	3.36	3.53	3.72	4.16
	CSELB 2004-030-6		3				50	6	3.21	3.36	3.53	3.72	4.16
	CSELB 2004-035		3.5				45	4	3.74	3.91	4.11	4.33	4.85
	CSELB 2004-040		4				45	4	4.26	4.46	4.69	4.94	5.53
	CSELB 2004-040-6		4				50	6	4.26	4.46	4.69	4.94	5.53
	CSELB 2004-045		4.5				45	4	4.78	5.01	5.27	5.55	6.21
	CSELB 2004-050		5				45	4	5.31	5.56	5.84	6.16	6.90
	CSELB 2004-060		6				45	4	6.35	6.66	7.00	7.38	8.27

※Additional model

Next Page ➡

2 Flutes UTCOAT

Unit（mm）

	Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
									30'	1°	1°30'	2°	3°
	CSELB 2005-010		1				45	4	1.13	1.17	1.23	1.28	1.42
※	CSELB 2005-0125		1.25				45	4	1.38	1.43	1.50	1.57	1.74
	CSELB 2005-015		1.5				45	4	1.64	1.71	1.79	1.88	2.09
	CSELB 2005-015-6		1.5				50	6	1.64	1.71	1.79	1.88	2.09
※	CSELB 2005-0175		1.75				45	4	1.90	1.98	2.08	2.18	2.43
	CSELB 2005-020		2				45	4	2.16	2.26	2.37	2.49	2.77
	CSELB 2005-020-6		2				50	6	2.16	2.26	2.37	2.49	2.77
※	CSELB 2005-0225		2.25				45	4	2.42	2.53	2.65	2.79	3.11
	CSELB 2005-025		2.5				45	4	2.68	2.81	2.94	3.10	3.45
	CSELB 2005-025-6		2.5				50	6	2.68	2.81	2.94	3.10	3.45
	CSELB 2005-030		3				45	4	3.21	3.36	3.52	3.70	4.14
	CSELB 2005-030-6	R0.25	3	0.4	0.49	11°	50	6	3.21	3.36	3.52	3.70	4.14
	CSELB 2005-035		3.5				45	4	3.73	3.91	4.10	4.31	4.82
	CSELB 2005-040		4				45	4	4.25	4.46	4.68	4.92	5.51
	CSELB 2005-040-6		4				50	6	4.25	4.46	4.68	4.92	5.51
	CSELB 2005-045		4.5				45	4	4.78	5.00	5.26	5.53	6.19
	CSELB 2005-050		5				45	4	5.30	5.55	5.83	6.14	6.88
	CSELB 2005-055		5.5				45	4	5.83	6.10	6.41	6.75	7.56
	CSELB 2005-060		6				45	4	6.35	6.65	6.99	7.36	8.25
	CSELB 2005-070		7				45	4	7.40	7.75	8.14	8.58	9.62
	CSELB 2005-080		8				45	4	8.44	8.85	9.30	9.80	10.99
	CSELB 2005-090		9				45	4	9.49	9.95	10.46	11.02	12.35
	CSELB 2005-100		10				50	4	10.54	11.05	11.61	12.24	13.72
	CSELB 2006-010		1				45	4	1.12	1.17	1.22	1.27	1.40
※	CSELB 2006-0125		1.25				45	4	1.37	1.43	1.49	1.56	1.73
	CSELB 2006-015		1.5				45	4	1.63	1.70	1.78	1.87	2.07
	CSELB 2006-015-6		1.5				50	6	1.63	1.70	1.78	1.87	2.07
※	CSELB 2006-0175		1.75				45	4	1.90	1.98	2.07	2.17	2.41
	CSELB 2006-020		2				45	4	2.16	2.25	2.36	2.48	2.75
	CSELB 2006-020-6		2				50	6	2.16	2.25	2.36	2.48	2.75
※	CSELB 2006-0225		2.25				45	4	2.42	2.53	2.65	2.78	3.09
	CSELB 2006-025		2.5				45	4	2.68	2.80	2.94	3.08	3.44
	CSELB 2006-025-6		2.5				50	6	2.68	2.80	2.94	3.08	3.44
	CSELB 2006-030		3				45	4	3.21	3.35	3.51	3.69	4.12
	CSELB 2006-030-6		3				50	6	3.21	3.35	3.51	3.69	4.12
	CSELB 2006-035		3.5				45	4	3.73	3.90	4.09	4.30	4.81
	CSELB 2006-040		4				45	4	4.25	4.45	4.67	4.91	5.49
	CSELB 2006-040-6	R0.3	4	0.48	0.59	11°	50	6	4.25	4.45	4.67	4.91	5.49
	CSELB 2006-045		4.5				45	4	4.78	5.00	5.25	5.52	6.18
	CSELB 2006-050		5				45	4	5.30	5.55	5.83	6.13	6.86
	CSELB 2006-050-6		5				50	6	5.30	5.55	5.83	6.13	6.86
	CSELB 2006-055		5.5				45	4	5.82	6.10	6.40	6.74	7.54
	CSELB 2006-060		6				45	4	6.35	6.65	6.98	7.35	8.23
	CSELB 2006-060-6		6				50	6	6.35	6.65	6.98	7.35	8.23
	CSELB 2006-065		6.5				45	4	6.87	7.20	7.56	7.96	8.91
	CSELB 2006-070		7				45	4	7.39	7.75	8.14	8.57	9.60
	CSELB 2006-080		8				45	4	8.44	8.85	9.29	9.79	10.97
	CSELB 2006-080-6		8				50	6	8.44	8.85	9.29	9.79	10.97
	CSELB 2006-090		9				45	4	9.49	9.94	10.45	11.01	12.34
	CSELB 2006-100		10				50	4	10.53	11.04	11.60	12.23	13.71
	CSELB 2006-100-6		10				50	6	10.53	11.04	11.60	12.23	13.71
	CSELB 2006-120		12				50	4	12.63	13.24	13.92	14.66	16.44

※Additional model

Next Page ➡

Unit（mm）

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
CSELB 2007-020	R0.35	2	0.56	0.69	11°	45	4	2.16	2.25	2.35	2.46	2.73
CSELB 2007-040		4				45	4	4.25	4.45	4.66	4.90	5.47
CSELB 2007-060		6				45	4	6.34	6.64	6.97	7.34	8.21
CSELB 2007-080		8				45	4	8.44	8.84	9.28	9.78	10.95
CSELB 2008-020	R0.4	2	0.64	0.79	11°	45	4	2.15	2.24	2.34	2.45	2.72
CSELB 2008-020-6		2				50	6	2.15	2.24	2.34	2.45	2.72
CSELB 2008-030		3				45	4	3.20	3.34	3.50	3.67	4.09
CSELB 2008-030-6		3				50	6	3.20	3.34	3.50	3.67	4.09
CSELB 2008-040		4				45	4	4.25	4.44	4.65	4.89	5.45
CSELB 2008-040-6		4				50	6	4.25	4.44	4.65	4.89	5.45
CSELB 2008-050		5				45	4	5.29	5.54	5.81	6.11	6.82
CSELB 2008-060		6				45	4	6.34	6.64	6.97	7.33	8.19
CSELB 2008-060-6		6				50	6	6.34	6.64	6.97	7.33	8.19
CSELB 2008-070		7				45	4	7.39	7.74	8.12	8.55	9.56
CSELB 2008-080		8				45	4	8.44	8.84	9.28	9.77	10.93
CSELB 2008-080-6		8				50	6	8.44	8.84	9.28	9.77	10.93
CSELB 2008-090		9				45	4	9.48	9.93	10.43	10.99	12.30
CSELB 2008-100		10				50	4	10.53	11.03	11.59	12.21	13.67
CSELB 2008-100-6		10				50	6	10.53	11.03	11.59	12.21	13.67
CSELB 2008-120		12				45	4	12.62	13.23	13.90	14.64	16.41
CSELB 2009-020	R0.45	2	0.72	0.89	11°	45	4	2.15	2.24	2.34	2.44	2.70
CSELB 2009-040		4				45	4	4.25	4.44	4.65	4.88	5.44
CSELB 2009-060		6				45	4	6.34	6.63	6.96	7.32	8.17
CSELB 2009-080		8				45	4	8.43	8.83	9.27	9.76	10.91
CSELB 2009-100		10				45	4	10.53	11.03	11.58	12.19	13.65
CSELB 2009-120		12				45	4	12.62	13.23	13.89	14.63	16.39
CSELB 2009-140		14				50	4	14.72	15.42	16.20	17.07	19.13
CSELB 2009-160		16				50	4	16.81	17.62	18.51	19.51	21.87
CSELB 2009-180		18				55	4	18.90	19.82	20.83	21.95	24.60

Next Page ➡

2 Flutes UTCOAT

Unit (mm)

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
CSELB 2010-020		2				45	4	2.17	2.25	2.35	2.45	2.70
CSELB 2010-025		2.5				45	4	2.69	2.80	2.92	3.06	3.39
CSELB 2010-030		3				45	4	3.21	3.35	3.50	3.67	4.07
CSELB 2010-030-6		3				50	6	3.21	3.35	3.50	3.67	4.07
CSELB 2010-040		4				45	4	4.26	4.45	4.66	4.89	5.44
CSELB 2010-040-6		4				50	6	4.26	4.45	4.66	4.89	5.44
CSELB 2010-050		5				45	4	5.31	5.55	5.81	6.11	6.81
CSELB 2010-050-6		5				50	6	5.31	5.55	5.81	6.11	6.81
CSELB 2010-060		6				45	4	6.35	6.65	6.97	7.33	8.18
CSELB 2010-060-6		6				50	6	6.35	6.65	6.97	7.33	8.18
CSELB 2010-070		7				45	4	7.40	7.74	8.12	8.55	9.55
CSELB 2010-070-6		7				50	6	7.40	7.74	8.12	8.55	9.55
CSELB 2010-080		8				45	4	8.45	8.84	9.28	9.76	10.92
CSELB 2010-080-6	R0.5	8	0.8	0.98	11°	50	6	8.45	8.84	9.28	9.76	10.92
CSELB 2010-090		9				45	4	9.49	9.94	10.44	10.98	12.29
CSELB 2010-100		10				45	4	10.54	11.04	11.59	12.20	13.65
CSELB 2010-100-6		10				50	6	10.54	11.04	11.59	12.20	13.65
CSELB 2010-120		12				45	4	12.64	13.24	13.90	14.64	16.39
CSELB 2010-120-6		12				50	6	12.64	13.24	13.90	14.64	16.39
CSELB 2010-140		14				50	4	14.73	15.43	16.21	17.08	19.13
CSELB 2010-140-6		14				60	6	14.73	15.43	16.21	17.08	19.13
CSELB 2010-160		16				50	4	16.82	17.63	18.53	19.52	21.87
CSELB 2010-160-6		16				60	6	16.82	17.63	18.53	19.52	21.87
CSELB 2010-180		18				55	4	18.92	19.83	20.84	21.95	24.61
CSELB 2010-200		20				55	4	21.01	22.03	23.15	24.39	27.35
CSELB 2010-200-6		20				70	6	21.01	22.03	23.15	24.39	27.35
CSELB 2010-220-6		22				70	6	23.11	24.22	25.46	26.83	30.08
CSELB 2012-025		2.5				45	4	2.58	2.68	2.80	2.92	3.22
CSELB 2012-040		4				45	4	4.15	4.33	4.53	4.75	5.27
CSELB 2012-060		6				45	4	6.25	6.53	6.84	7.19	8.01
CSELB 2012-060-6		6				50	6	6.25	6.53	6.84	7.19	8.01
CSELB 2012-080		8				45	4	8.34	8.73	9.15	9.63	10.75
CSELB 2012-080-6		8				50	6	8.34	8.73	9.15	9.63	10.75
CSELB 2012-100		10				45	4	10.44	10.92	11.46	12.06	13.49
CSELB 2012-100-6	R0.6	10	0.96	1.19	11°	50	6	10.44	10.92	11.46	12.06	13.49
CSELB 2012-120		12				45	4	12.53	13.12	13.78	14.50	16.23
CSELB 2012-120-6		12				50	6	12.53	13.12	13.78	14.50	16.23
CSELB 2012-140		14				50	4	14.62	15.32	16.09	16.94	18.96
CSELB 2012-160		16				50	4	16.72	17.52	18.40	19.38	21.70
CSELB 2012-160-6		16				60	6	16.72	17.52	18.40	19.38	21.70
CSELB 2012-180		18				55	4	18.81	19.71	20.71	21.82	24.44
CSELB 2012-200		20				60	4	20.91	21.91	23.02	24.25	27.18

Next Page ➡

Unit（mm）

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
CSELB 2014-060	R0.7	6	1.12	1.37	11°	45	4	6.30	6.58	6.89	7.23	8.04
CSELB 2014-080		8				45	4	8.39	8.77	9.20	9.67	10.78
CSELB 2014-120		12				45	4	12.58	13.17	13.82	14.54	16.26
CSELB 2014-160		16				50	4	16.77	17.56	18.44	19.42	21.74
CSELB 2015-030	R0.75	3	1.2	1.47	11°	45	4	3.15	3.28	3.41	3.56	3.92
CSELB 2015-040		4				45	4	4.20	4.37	4.57	4.78	5.29
CSELB 2015-060		6				45	4	6.29	6.57	6.88	7.22	8.03
CSELB 2015-060-6		6				50	6	6.29	6.57	6.88	7.22	8.03
CSELB 2015-080		8				45	4	8.39	8.77	9.19	9.66	10.77
CSELB 2015-080-6		8				50	6	8.39	8.77	9.19	9.66	10.77
CSELB 2015-100		10				45	4	10.48	10.97	11.50	12.09	13.50
CSELB 2015-100-6		10				50	6	10.48	10.97	11.50	12.09	13.50
CSELB 2015-120		12				45	4	12.58	13.16	13.81	14.53	16.24
CSELB 2015-120-6		12				50	6	12.58	13.16	13.81	14.53	16.24
CSELB 2015-140		14				50	4	14.67	15.36	16.12	16.97	18.98
CSELB 2015-160		16				50	4	16.76	17.56	18.43	19.41	21.72
CSELB 2015-160-6		16				60	6	16.76	17.56	18.43	19.41	21.72
CSELB 2015-180		18				55	4	18.86	19.76	20.75	21.85	24.46
CSELB 2015-200		20				55	4	20.95	21.95	23.06	24.28	No Interference
CSELB 2015-200-6		20				60	6	20.95	21.95	23.06	24.28	27.19
CSELB 2015-220		22				55	4	23.05	24.15	25.37	26.72	No Interference
CSELB 2015-250		25				65	4	26.19	27.45	28.84	30.38	No Interference
CSELB 2015-300		30				70	4	31.42	32.94	34.61	36.47	No Interference
CSELB 2016-040	R0.8	4	1.28	1.58	11°	45	4	4.17	4.34	4.53	4.74	5.24
CSELB 2016-080		8				45	4	8.36	8.74	9.15	9.61	10.71
CSELB 2016-120		12				45	4	12.55	13.13	13.77	14.49	16.19
CSELB 2016-160		16				50	4	16.74	17.53	18.40	19.37	21.66
CSELB 2016-200		20				55	4	20.92	21.92	23.02	24.24	No Interference
CSELB 2018-040	R0.9	4	1.44	1.78	11°	45	4	4.17	4.33	4.51	4.72	5.20
CSELB 2018-060		6				45	4	6.26	6.53	6.83	7.15	7.94
CSELB 2018-080		8				45	4	8.35	8.73	9.14	9.59	10.68
CSELB 2018-100		10				45	4	10.45	10.92	11.45	12.03	13.41
CSELB 2018-120		12				45	4	12.54	13.12	13.76	14.47	16.15
CSELB 2018-160		16				50	4	16.73	17.52	18.38	19.34	21.63
CSELB 2018-180		18				55	4	18.82	19.71	20.69	21.78	No Interference
CSELB 2018-200		20				55	4	20.92	21.91	23.00	24.22	No Interference
CSELB 2018-220		22				60	4	23.01	24.11	25.32	26.66	No Interference
CSELB 2018-250		25				65	4	26.15	27.40	28.78	30.32	No Interference
CSELB 2018-300		30				70	4	31.39	32.90	34.56	No Interference	No Interference

Next Page ➡

2 Flutes UTCOAT

Unit (mm)

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
CSELB 2020-030	R1	3	1.6	1.98	11°	45	4	3.11	3.22	3.34	3.48	3.79
CSELB 2020-040		4				45	4	4.16	4.32	4.50	4.70	5.16
CSELB 2020-040-6		4				50	6	4.16	4.32	4.50	4.70	5.16
CSELB 2020-060		6				45	4	6.26	6.52	6.81	7.13	7.90
CSELB 2020-060-6		6				50	6	6.26	6.52	6.81	7.13	7.90
CSELB 2020-080		8				45	4	8.35	8.72	9.12	9.57	10.64
CSELB 2020-080-6		8				50	6	8.35	8.72	9.12	9.57	10.64
CSELB 2020-100		10				45	4	10.44	10.91	11.43	12.01	13.38
CSELB 2020-100-6		10				50	6	10.44	10.91	11.43	12.01	13.38
CSELB 2020-120		12				45	4	12.54	13.11	13.74	14.45	16.12
CSELB 2020-120-6		12				50	6	12.54	13.11	13.74	14.45	16.12
CSELB 2020-130		13				45	4	13.59	14.21	14.90	15.67	17.49
CSELB 2020-140		14				50	4	14.63	15.31	16.06	16.89	18.85
CSELB 2020-160		16				50	4	16.73	17.51	18.37	19.32	No Interference
CSELB 2020-160-6		16				60	6	16.73	17.51	18.37	19.32	21.59
CSELB 2020-180		18				55	4	18.82	19.70	20.68	21.76	No Interference
CSELB 2020-200		20				55	4	20.91	21.90	22.99	24.20	No Interference
CSELB 2020-200-6		20				70	6	20.91	21.90	22.99	24.20	27.07
CSELB 2020-220		22				60	4	23.01	24.10	25.30	26.64	No Interference
CSELB 2020-250		25				65	4	26.15	27.39	28.77	No Interference	No Interference
CSELB 2020-250-6		25				80	6	26.15	27.39	28.77	30.29	33.92
CSELB 2020-300		30				70	4	31.38	32.89	34.55	No Interference	No Interference
CSELB 2020-300-6		30				80	6	31.38	32.89	34.55	36.39	No Interference
CSELB 2020-350		35				80	4	36.62	38.38	No Interference	No Interference	No Interference
CSELB 2020-350-6		35				80	6	36.62	38.38	40.32	42.48	No Interference
CSELB 2020-400		40				80	4	41.85	43.87	No Interference	No Interference	No Interference
CSELB 2020-400-6		40				90	6	41.85	43.87	46.10	48.58	No Interference
CSELB 2025-060	R1.25	6	2	2.45	11°	45	4	6.33	6.58	6.86	7.17	7.92
CSELB 2025-080		8				45	4	8.42	8.78	9.17	9.61	10.66
CSELB 2025-100		10				45	4	10.51	10.97	11.48	12.05	13.39
CSELB 2025-150		15				50	4	15.75	16.47	17.26	18.14	No Interference
CSELB 2025-200		20				55	4	20.98	21.96	23.04	No Interference	No Interference
CSELB 2025-250		25				65	4	26.22	27.45	28.82	No Interference	No Interference
CSELB 2025-300		30				70	4	31.45	32.95	No Interference	No Interference	No Interference
CSELB 2025-350		35				70	4	36.69	38.44	No Interference	No Interference	No Interference
CSELB 2030-060	R1.5	6	2.4	2.95	11°	60	6	6.31	6.55	6.82	7.12	7.83
CSELB 2030-060-3		6			-	60	3	No Interference	No Interference	No Interference	No Interference	No Interference
CSELB 2030-060-4		6			11°	60	4	6.31	6.55	6.82	7.12	7.83
CSELB 2030-080		8				60	6	8.41	8.75	9.13	9.56	10.57
CSELB 2030-100		10				60	6	10.50	10.95	11.44	12.00	13.30
CSELB 2030-120		12				60	6	12.60	13.15	13.76	14.43	16.04
CSELB 2030-140		14				60	6	14.69	15.34	16.07	16.87	18.78
CSELB 2030-150		15				60	6	15.74	16.44	17.22	18.09	20.15
CSELB 2030-160		16				60	6	16.78	17.54	18.38	19.31	21.52
CSELB 2030-200		20				70	6	20.97	21.94	23.00	24.19	27.00
CSELB 2030-250		25				70	6	26.21	27.43	28.78	30.28	No Interference
CSELB 2030-300		30				70	6	31.44	32.92	34.56	36.38	No Interference
CSELB 2030-350		35				80	6	36.68	38.42	40.34	42.47	No Interference
CSELB 2030-400		40				80	6	41.91	43.91	46.12	No Interference	No Interference

Next Page ➡

Unit（mm）

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
CSELB 2035-100	R1.75	10	2.8	3.45	11°	60	6	10.49	10.93	11.41	11.94	13.21
CSELB 2035-150		15				60	6	15.72	16.42	17.19	18.04	20.06
CSELB 2035-200		20				65	6	20.96	21.91	22.96	24.13	No Interference
CSELB 2035-250		25				70	6	26.19	27.40	28.74	30.23	No Interference
CSELB 2035-300		30				70	6	31.43	32.90	34.52	36.32	No Interference
CSELB 2035-400		40				90	6	41.90	43.88	46.08	No Interference	No Interference
CSELB 2035-450		45				90	6	47.13	49.38	No Interference	No Interference	No Interference
CSELB 2040-080	R2	8	3.2	3.95	11°	70	6	8.38	8.70	9.06	9.45	10.39
CSELB 2040-080-4		8			-	70	4	No Interference	No Interference	No Interference	No Interference	No Interference
CSELB 2040-100		10			11°	70	6	10.48	10.90	11.37	11.89	13.12
CSELB 2040-120		12				70	6	12.57	13.10	13.68	14.33	15.86
CSELB 2040-140		14				70	6	14.67	15.30	15.99	16.76	18.60
CSELB 2040-150		15				70	6	15.71	16.39	17.15	17.98	19.97
CSELB 2040-160		16				70	6	16.76	17.49	18.30	19.20	No Interference
CSELB 2040-200		20				70	6	20.95	21.89	22.93	24.08	No Interference
CSELB 2040-250		25				70	6	26.18	27.38	28.70	30.17	No Interference
CSELB 2040-300		30				70	6	31.42	32.87	34.48	No Interference	No Interference
CSELB 2040-350		35				80	6	36.65	38.37	40.26	No Interference	No Interference
CSELB 2040-400		40				90	6	41.89	43.86	No Interference	No Interference	No Interference
CSELB 2040-450		45				90	6	47.12	49.35	No Interference	No Interference	No Interference
CSELB 2040-500		50				100	6	52.36	54.85	No Interference	No Interference	No Interference
CSELB 2040-600		60				120	6	62.83	No Interference	No Interference	No Interference	No Interference
CSELB 2050-100	R2.5	10	4	4.95	11°	70	6	10.45	10.85	11.29	11.78	No Interference
CSELB 2050-150		15				70	6	15.69	16.35	17.07	No Interference	No Interference
CSELB 2050-200		20				70	6	20.92	21.84	No Interference	No Interference	No Interference
CSELB 2050-250		25				70	6	26.16	27.33	No Interference	No Interference	No Interference
CSELB 2050-300		30				80	6	31.39	No Interference	No Interference	No Interference	No Interference
CSELB 2050-350		35				80	6	36.63	No Interference	No Interference	No Interference	No Interference
CSELB 2050-400		40				90	6	41.86	No Interference	No Interference	No Interference	No Interference
CSELB 2050-450		45				100	6	47.10	No Interference	No Interference	No Interference	No Interference
CSELB 2050-500		50				100	6	52.33	No Interference	No Interference	No Interference	No Interference
CSELB 2060-100	R3	10	4.8	5.95		80	6	No Interference	No Interference	No Interference	No Interference	No Interference
CSELB 2060-150		15				80	6	No Interference	No Interference	No Interference	No Interference	No Interference
CSELB 2060-200		20				80	6	No Interference	No Interference	No Interference	No Interference	No Interference
CSELB 2060-250		25				80	6	No Interference	No Interference	No Interference	No Interference	No Interference
CSELB 2060-300		30				80	6	No Interference	No Interference	No Interference	No Interference	No Interference
CSELB 2060-350		35				80	6	No Interference	No Interference	No Interference	No Interference	No Interference
CSELB 2060-400		40				90	6	No Interference	No Interference	No Interference	No Interference	No Interference
CSELB 2060-450		45				100	6	No Interference	No Interference	No Interference	No Interference	No Interference
CSELB 2060-500		50				120	6	No Interference	No Interference	No Interference	No Interference	No Interference
CSELB 2060-600		60				120	6	No Interference	No Interference	No Interference	No Interference	No Interference

Milling Conditions for CSELB

WORK MATERIAL			COPPER / ALUMINUM ALLOYS				CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB)				PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC)				HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2001-002		0.2	54,000	85	0.004	0.004	54,000	85	0.004	0.004	48,000	55	0.002	0.002	48,000	55	0.002	0.002
2001-003	**R0.05**	0.3	54,000	85	0.004	0.004	54,000	85	0.004	0.004	48,000	55	0.002	0.002	48,000	55	0.002	0.002
2001-005		0.5	54,000	75	0.004	0.004	54,000	75	0.004	0.004	48,000	35	0.002	0.002	48,000	35	0.002	0.002
20015-003		0.3	54,000	160	0.007	0.009	54,000	160	0.007	0.009	48,000	90	0.004	0.004	48,000	90	0.004	0.004
20015-005	**R0.075**	0.5	54,000	140	0.007	0.009	54,000	140	0.007	0.009	48,000	60	0.004	0.004	48,000	60	0.004	0.004
20015-010		1	54,000	100	0.003	0.005	54,000	100	0.003	0.005	48,000	60	0.001	0.002	48,000	60	0.001	0.002
2002-003		0.3	60,000	350	0.008	0.024	60,000	350	0.008	0.016	60,000	300	0.008	0.024	60,000	300	0.006	0.018
2002-005		0.5	60,000	350	0.008	0.024	60,000	350	0.008	0.016	60,000	300	0.008	0.024	60,000	300	0.006	0.018
2002-0075		0.75	60,000	300	0.007	0.021	60,000	320	0.007	0.015	60,000	300	0.007	0.021	60,000	270	0.005	0.015
2002-010		1	60,000	250	0.006	0.018	60,000	250	0.005	0.015	60,000	250	0.006	0.018	60,000	220	0.005	0.015
2002-0125		1.25	54,000	225	0.005	0.016	54,000	215	0.004	0.013	60,000	225	0.005	0.016	54,000	195	0.004	0.013
2002-015	**R0.1**	1.5	48,000	200	0.005	0.015	48,000	180	0.004	0.012	60,000	200	0.005	0.015	48,000	170	0.004	0.012
2002-0175		1.75	48,000	175	0.004	0.012	48,000	165	0.003	0.01	60,000	175	0.004	0.012	48,000	145	0.003	0.009
2002-020		2	48,000	150	0.003	0.009	48,000	150	0.003	0.009	60,000	150	0.003	0.009	48,000	120	0.003	0.007
2002-0225		2.25	44,000	125	0.003	0.007	44,000	125	0.003	0.007	53,000	125	0.002	0.007	44,000	110	0.002	0.005
2002-025		2.5	40,000	100	0.003	0.006	40,000	100	0.003	0.006	46,000	100	0.002	0.006	40,000	100	0.002	0.004
2002-030		3	33,000	50	0.002	0.003	33,000	50	0.002	0.003	33,000	50	0.002	0.003	33,000	50	0.002	0.002
2003-005		0.5	43,000	500	0.012	0.036	43,000	500	0.012	0.024	54,000	450	0.012	0.036	43,000	450	0.008	0.024
2003-006		0.6	43,000	500	0.012	0.036	43,000	500	0.012	0.024	54,000	450	0.012	0.036	43,000	450	0.008	0.024
2003-0075		0.75	43,000	500	0.012	0.036	43,000	500	0.012	0.024	54,000	450	0.012	0.036	43,000	450	0.008	0.024
2003-010		1	43,000	450	0.01	0.03	43,000	450	0.008	0.024	54,000	400	0.01	0.03	43,000	400	0.007	0.021
2003-0125		1.25	43,000	425	0.009	0.027	43,000	425	0.007	0.022	54,000	400	0.009	0.027	43,000	400	0.006	0.019
2003-015		1.5	43,000	400	0.008	0.024	43,000	400	0.007	0.021	54,000	400	0.008	0.024	43,000	400	0.006	0.018
2003-0175	**R0.15**	1.75	41,500	350	0.007	0.021	41,500	350	0.006	0.019	52,000	350	0.007	0.022	41,500	350	0.005	0.016
2003-020		2	40,000	300	0.006	0.018	40,000	300	0.006	0.018	50,000	300	0.007	0.021	40,000	300	0.005	0.015
2003-0225		2.25	40,000	275	0.005	0.016	40,000	275	0.005	0.016	48,000	275	0.006	0.018	40,000	275	0.004	0.013
2003-025		2.5	40,000	250	0.005	0.015	40,000	250	0.005	0.015	46,000	250	0.005	0.015	40,000	250	0.004	0.012
2003-030		3	38,000	200	0.004	0.012	38,000	200	0.004	0.012	42,000	200	0.004	0.012	38,000	200	0.004	0.008
2003-040		4	35,000	100	0.003	0.009	35,000	100	0.003	0.009	35,000	100	0.003	0.009	32,000	100	0.003	0.005
2003-050		5	26,000	60	0.003	0.004	26,000	60	0.003	0.004	26,000	60	0.003	0.004	26,000	60	0.003	0.003
2004-005		0.5	35,000	1,200	0.03	0.09	35,000	1,200	0.02	0.04	50,000	650	0.025	0.075	35,000	650	0.015	0.045
2004-0075		0.75	35,000	1,200	0.03	0.09	35,000	1,200	0.02	0.04	50,000	650	0.025	0.075	35,000	650	0.015	0.045
2004-010		1	35,000	1,200	0.03	0.09	35,000	1,200	0.02	0.04	50,000	650	0.025	0.075	35,000	650	0.015	0.045
2004-0125		1.25	35,000	1,050	0.025	0.075	35,000	1,050	0.018	0.036	50,000	600	0.022	0.067	35,000	575	0.013	0.04
2004-015		1.5	35,000	900	0.02	0.06	35,000	900	0.016	0.033	50,000	550	0.02	0.06	35,000	500	0.012	0.036
2004-0175		1.75	35,000	750	0.017	0.052	35,000	750	0.013	0.033	50,000	525	0.017	0.052	35,000	450	0.011	0.033
2004-020		2	35,000	600	0.015	0.045	35,000	600	0.011	0.033	50,000	500	0.015	0.045	35,000	400	0.01	0.03
2004-0225	**R0.2**	2.25	35,000	525	0.013	0.04	35,000	525	0.01	0.031	48,000	475	0.013	0.04	35,000	380	0.01	0.027
2004-025		2.5	35,000	450	0.012	0.036	35,000	450	0.01	0.03	46,000	450	0.012	0.036	35,000	360	0.01	0.025
2004-030		3	35,000	400	0.01	0.03	35,000	400	0.008	0.024	42,000	400	0.01	0.03	35,000	330	0.007	0.021
2004-035		3.5	35,000	350	0.007	0.02	35,000	350	0.006	0.018	38,000	350	0.007	0.021	35,000	300	0.007	0.018
2004-040		4	35,000	300	0.005	0.015	35,000	300	0.005	0.015	35,000	300	0.005	0.015	35,000	250	0.005	0.015
2004-045		4.5	32,000	230	0.004	0.012	32,000	230	0.004	0.012	32,000	230	0.004	0.012	32,000	200	0.004	0.01
2004-050		5	30,000	160	0.003	0.01	30,000	160	0.003	0.01	30,000	160	0.003	0.01	30,000	150	0.003	0.008
2004-060		6	23,000	90	0.003	0.005	23,000	90	0.003	0.005	23,000	90	0.003	0.005	23,000	80	0.003	0.004

Next Page ➡

Milling Conditions for CSELB

WORK MATERIAL			COPPER / ALUMINUM ALLOYS				CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB)				PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC)				HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2005-010	R0.25	1	34,000	1,300	0.035	0.105	34,000	1,300	0.03	0.06	45,000	900	0.03	0.09	32,000	900	0.02	0.06
2005-0125		1.25	34,000	1,150	0.032	0.097	34,000	1,150	0.027	0.055	45,000	850	0.027	0.082	32,000	850	0.019	0.057
2005-015		1.5	34,000	1,000	0.03	0.09	34,000	1,000	0.025	0.05	45,000	800	0.025	0.075	32,000	800	0.018	0.054
2005-0175		1.75	34,000	900	0.027	0.082	34,000	900	0.024	0.048	45,000	750	0.023	0.07	32,000	750	0.017	0.051
2005-020		2	34,000	800	0.025	0.075	34,000	800	0.023	0.046	45,000	700	0.022	0.066	32,000	700	0.016	0.048
2005-0225		2.25	34,000	750	0.022	0.067	34,000	750	0.019	0.045	45,000	650	0.02	0.06	32,000	650	0.015	0.046
2005-025		2.5	34,000	700	0.02	0.06	34,000	700	0.015	0.045	45,000	600	0.018	0.054	32,000	600	0.015	0.045
2005-030		3	32,000	550	0.016	0.048	32,000	550	0.012	0.036	41,000	550	0.014	0.042	31,000	500	0.012	0.036
2005-035		3.5	32,000	500	0.014	0.042	32,000	500	0.011	0.033	38,000	500	0.012	0.036	30,500	450	0.01	0.03
2005-040		4	31,000	450	0.012	0.036	31,000	450	0.01	0.03	35,000	450	0.01	0.03	30,000	390	0.01	0.03
2005-045		4.5	30,000	390	0.01	0.03	30,000	390	0.008	0.024	32,000	390	0.008	0.024	29,500	350	0.008	0.024
2005-050		5	29,000	340	0.007	0.021	29,000	340	0.007	0.021	29,000	340	0.006	0.018	29,000	300	0.006	0.018
2005-055		5.5	26,000	280	0.007	0.021	26,000	280	0.007	0.021	26,000	280	0.006	0.018	26,000	250	0.006	0.018
2005-060		6	24,000	220	0.006	0.018	24,000	220	0.006	0.018	24,000	220	0.005	0.015	24,000	200	0.005	0.015
2005-070		7	21,000	180	0.005	0.015	21,000	180	0.005	0.015	21,000	180	0.004	0.012	21,000	160	0.004	0.012
2005-080		8	19,000	130	0.004	0.012	19,000	130	0.004	0.012	19,000	130	0.003	0.009	19,000	110	0.003	0.009
2005-090		9	18,000	120	0.003	0.009	18,000	120	0.003	0.009	18,000	120	0.002	0.008	18,000	100	0.002	0.008
2005-100		10	17,000	100	0.003	0.009	17,000	100	0.003	0.009	17,000	100	0.002	0.006	17,000	80	0.002	0.006
2006-010	R0.3	1	33,000	1,500	0.05	0.15	33,000	1,500	0.04	0.08	40,000	1,300	0.045	0.09	30,000	1,300	0.04	0.06
2006-0125		1.25	33,000	1,500	0.05	0.15	33,000	1,500	0.04	0.08	40,000	1,300	0.045	0.09	30,000	1,300	0.04	0.06
2006-015		1.5	33,000	1,500	0.05	0.15	33,000	1,500	0.04	0.08	40,000	1,300	0.045	0.09	30,000	1,300	0.04	0.06
2006-0175		1.75	33,000	1,450	0.047	0.142	33,000	1,450	0.038	0.076	40,000	1,250	0.045	0.09	30,000	1,250	0.038	0.057
2006-020		2	33,000	1,400	0.045	0.135	33,000	1,400	0.036	0.072	40,000	1,200	0.045	0.09	30,000	1,200	0.036	0.054
2006-0225		2.25	33,000	1,250	0.042	0.127	33,000	1,300	0.034	0.069	40,000	1,100	0.042	0.085	30,000	1,150	0.034	0.053
2006-025		2.5	33,000	1,100	0.04	0.12	33,000	1,200	0.033	0.066	40,000	1,000	0.04	0.08	30,000	1,100	0.033	0.053
2006-030		3	33,000	900	0.035	0.105	33,000	900	0.025	0.066	40,000	800	0.03	0.075	30,000	900	0.026	0.052
2006-035		3.5	32,000	900	0.03	0.09	32,000	800	0.022	0.066	38,000	650	0.025	0.075	28,000	720	0.02	0.06
2006-040		4	31,000	700	0.027	0.081	31,000	700	0.02	0.06	35,000	560	0.022	0.066	28,000	600	0.018	0.054
2006-045		4.5	29,000	500	0.024	0.072	29,000	550	0.017	0.051	32,000	500	0.018	0.054	26,000	500	0.015	0.045
2006-050		5	29,000	440	0.018	0.054	29,000	440	0.015	0.045	29,000	440	0.015	0.045	26,000	440	0.012	0.036
2006-055		5.5	26,000	410	0.016	0.048	26,000	410	0.014	0.042	26,000	410	0.014	0.042	25,000	410	0.01	0.03
2006-060		6	24,000	380	0.012	0.036	24,000	380	0.012	0.036	24,000	380	0.01	0.03	24,000	380	0.008	0.024
2006-065		6.5	22,000	340	0.011	0.033	22,000	340	0.011	0.033	22,000	340	0.009	0.027	22,000	340	0.007	0.021
2006-070		7	21,000	310	0.01	0.03	21,000	310	0.01	0.03	21,000	310	0.008	0.024	21,000	310	0.006	0.018
2006-080		8	18,000	240	0.008	0.024	18,000	240	0.008	0.024	18,000	240	0.006	0.018	18,000	240	0.005	0.015
2006-090		9	16,000	180	0.007	0.021	16,000	180	0.007	0.021	16,000	180	0.005	0.015	16,000	180	0.004	0.012
2006-100		10	15,000	160	0.006	0.018	15,000	160	0.006	0.018	15,000	160	0.004	0.012	15,000	160	0.003	0.01
2006-120		12	14,000	150	0.005	0.015	14,000	150	0.005	0.015	14,000	150	0.003	0.009	14,000	150	0.002	0.008
2007-020	R0.35	2	32,000	1,800	0.07	0.21	32,000	1,600	0.05	0.1	38,000	1,600	0.06	0.12	28,000	1,600	0.05	0.075
2007-040		4	32,000	1,000	0.05	0.15	32,000	900	0.03	0.09	34,000	800	0.04	0.12	28,000	800	0.03	0.06
2007-060		6	26,000	550	0.022	0.066	26,000	550	0.018	0.054	26,000	500	0.018	0.054	23,000	500	0.014	0.042
2007-080		8	19,000	340	0.012	0.036	19,000	340	0.012	0.036	19,000	320	0.01	0.03	19,000	320	0.008	0.024

Next Page ➡

Milling Conditions for CSELB

WORK MATERIAL			COPPER / ALUMINUM ALLOYS				CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB)				PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC)				HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2008-020		2	30,000	2,200	0.1	0.3	30,000	1,800	0.06	0.12	35,000	1,800	0.07	0.14	25,000	1,700	0.07	0.1
2008-030		3	30,000	1,700	0.08	0.24	30,000	1,600	0.05	0.1	35,000	1,600	0.06	0.12	25,000	1,500	0.06	0.09
2008-040		4	30,000	1,400	0.07	0.21	30,000	1,300	0.04	0.1	35,000	1,300	0.05	0.12	25,000	1,200	0.045	0.09
2008-050		5	30,000	1,100	0.06	0.18	30,000	1,100	0.035	0.1	30,000	1,100	0.04	0.12	25,000	1,000	0.04	0.08
2008-060	**R0.4**	6	27,000	900	0.04	0.12	27,000	900	0.025	0.075	27,000	800	0.03	0.09	23,000	800	0.023	0.069
2008-070		7	24,000	700	0.025	0.075	24,000	700	0.022	0.066	24,000	600	0.02	0.06	21,000	600	0.015	0.045
2008-080		8	19,000	450	0.02	0.06	19,000	450	0.02	0.06	19,000	450	0.015	0.045	19,000	450	0.01	0.03
2008-090		9	18,000	400	0.016	0.048	18,000	400	0.016	0.048	18,000	360	0.013	0.039	18,000	360	0.009	0.027
2008-100		10	15,000	350	0.012	0.036	15,000	350	0.012	0.036	15,000	300	0.01	0.03	15,000	300	0.007	0.021
2008-120		12	14,000	300	0.01	0.03	14,000	300	0.01	0.03	14,000	240	0.006	0.018	14,000	240	0.006	0.018
2009-020		2	30,000	2,100	0.11	0.33	30,000	1,600	0.07	0.14	33,000	1,700	0.08	0.16	24,000	1,600	0.08	0.12
2009-040		4	30,000	1,600	0.08	0.24	30,000	1,500	0.055	0.12	33,000	1,400	0.06	0.14	24,000	1,300	0.05	0.1
2009-060		6	27,000	1,100	0.06	0.18	27,000	1,100	0.035	0.1	27,000	850	0.04	0.12	22,000	800	0.034	0.1
2009-080		8	22,000	710	0.03	0.09	22,000	700	0.023	0.069	22,000	560	0.021	0.063	18,500	550	0.017	0.051
2009-100	**R0.45**	10	18,000	500	0.02	0.06	18,000	500	0.018	0.054	18,000	430	0.015	0.045	18,000	430	0.01	0.03
2009-120		12	16,000	420	0.015	0.045	16,000	420	0.015	0.045	16,000	350	0.009	0.027	16,000	350	0.007	0.021
2009-140		14	14,000	380	0.012	0.042	14,000	380	0.012	0.042	14,000	280	0.006	0.018	14,000	280	0.006	0.018
2009-160		16	13,500	360	0.01	0.04	13,500	360	0.01	0.04	13,500	200	0.004	0.016	13,500	200	0.004	0.016
2009-180		18	13,000	340	0.006	0.024	13,000	340	0.006	0.024	13,000	120	0.003	0.012	13,000	120	0.003	0.012
2010-020		2	30,000	2,000	0.12	0.36	30,000	1,600	0.08	0.16	30,000	1,600	0.09	0.18	22,000	1,600	0.09	0.13
2010-025		2.5	30,000	2,000	0.12	0.36	30,000	1,600	0.08	0.16	30,000	1,600	0.09	0.18	22,000	1,600	0.09	0.13
2010-030		3	30,000	1,800	0.11	0.33	24,000	1,600	0.07	0.14	30,000	1,500	0.08	0.16	21,500	1,400	0.08	0.12
2010-040		4	30,000	1,700	0.09	0.27	24,000	1,500	0.065	0.13	30,000	1,300	0.075	0.15	21,500	1,300	0.075	0.1
2010-050		5	30,000	1,600	0.08	0.24	24,000	1,400	0.06	0.12	30,000	1,200	0.07	0.14	21,500	1,200	0.06	0.09
2010-060		6	30,000	1,400	0.06	0.18	18,000	1,200	0.04	0.12	30,000	1,100	0.06	0.12	21,500	1,100	0.05	0.1
2010-070		7	27,000	1,200	0.05	0.15	17,000	1,000	0.03	0.09	24,000	800	0.04	0.12	20,000	900	0.03	0.09
2010-080	**R0.5**	8	24,000	1,000	0.04	0.12	16,500	900	0.027	0.081	18,500	620	0.035	0.1	18,500	580	0.025	0.1
2010-090		9	22,000	720	0.035	0.11	15,500	700	0.02	0.08	16,500	550	0.025	0.1	16,500	500	0.02	0.08
2010-100		10	20,000	650	0.03	0.09	15,000	500	0.018	0.072	14,800	490	0.02	0.08	14,800	430	0.015	0.06
2010-120		12	18,000	600	0.02	0.08	15,000	500	0.016	0.064	13,400	380	0.01	0.05	13,400	380	0.008	0.04
2010-140		14	16,000	530	0.015	0.06	14,000	460	0.015	0.06	12,000	350	0.008	0.04	12,000	350	0.006	0.03
2010-160		16	14,000	460	0.014	0.056	14,000	460	0.014	0.056	10,500	250	0.005	0.025	10,500	250	0.005	0.025
2010-180		18	13,500	440	0.012	0.06	13,500	440	0.012	0.06	9,500	200	0.004	0.02	9,500	200	0.004	0.02
2010-200		20	13,000	430	0.008	0.04	13,000	430	0.008	0.04	9,000	150	0.003	0.015	9,000	150	0.003	0.015
2010-220		22	12,000	380	0.007	0.035	12,000	380	0.007	0.035	8,500	120	0.002	0.01	8,500	120	0.002	0.01
2012-025		2.5	30,000	2,000	0.13	0.39	30,000	1,600	0.09	0.18	30,000	1,600	0.1	0.2	18,000	1,600	0.1	0.15
2012-040		4	30,000	1,800	0.12	0.36	20,000	1,500	0.08	0.16	30,000	1,400	0.09	0.18	18,000	1,400	0.09	0.13
2012-060		6	30,000	1,600	0.09	0.27	20,000	1,200	0.07	0.14	30,000	1,100	0.08	0.16	18,000	1,100	0.08	0.12
2012-080		8	25,000	1,200	0.06	0.18	15,000	900	0.05	0.12	20,000	800	0.06	0.15	16,500	750	0.05	0.11
2012-100	**R0.6**	10	20,000	900	0.05	0.15	13,500	650	0.035	0.11	16,000	640	0.045	0.12	15,500	550	0.03	0.09
2012-120		12	16,500	600	0.035	0.12	12,500	480	0.025	0.1	12,000	440	0.03	0.12	12,500	430	0.018	0.072
2012-140		14	14,500	520	0.025	0.1	12,500	480	0.022	0.088	11,000	400	0.015	0.06	11,500	370	0.014	0.056
2012-160		16	13,000	470	0.018	0.072	11,500	440	0.018	0.072	10,000	350	0.01	0.05	10,000	350	0.01	0.05
2012-180		18	12,000	460	0.014	0.07	11,250	440	0.014	0.07	9,500	260	0.008	0.04	9,500	260	0.007	0.035
2012-200		20	11,000	440	0.013	0.065	11,000	440	0.013	0.065	9,000	220	0.006	0.03	9,000	220	0.005	0.025

Next Page ➡

Milling Conditions for CSELB

WORK MATERIAL			COPPER / ALUMINUM ALLOYS				CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB)				PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC)				HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2014-060	R0.7	6	30,000	1,700	0.11	0.33	23,000	1,500	0.08	0.16	30,000	1,300	0.09	0.18	16,000	1,200	0.09	0.13
2014-080		8	30,000	1,400	0.09	0.27	17,000	1,000	0.06	0.15	30,000	1,000	0.07	0.17	15,000	900	0.06	0.12
2014-120		12	17,000	900	0.06	0.18	13,000	600	0.04	0.12	13,000	580	0.045	0.14	12,500	550	0.03	0.1
2014-160		16	12,500	540	0.028	0.12	11,000	500	0.024	0.1	9,500	380	0.016	0.08	9,500	380	0.015	0.06
2015-030	R0.75	3	30,000	2,000	0.15	0.45	30,000	1,600	0.12	0.24	30,000	1,700	0.12	0.24	18,000	1,500	0.12	0.18
2015-040		4	30,000	1,800	0.14	0.42	30,000	1,500	0.11	0.22	30,000	1,600	0.11	0.22	18,000	1,400	0.11	0.17
2015-060		6	30,000	1,800	0.12	0.36	23,000	1,300	0.1	0.2	30,000	1,400	0.1	0.2	15,000	1,200	0.1	0.16
2015-080		8	30,000	1,600	0.11	0.33	18,000	1,100	0.08	0.16	30,000	1,200	0.08	0.2	14,000	1,000	0.08	0.16
2015-100		10	23,000	1,200	0.09	0.27	15,000	850	0.06	0.15	23,500	900	0.06	0.18	14,000	700	0.05	0.15
2015-120		12	16,000	900	0.07	0.21	13,000	600	0.05	0.15	13,000	650	0.05	0.15	13,000	550	0.03	0.12
2015-140		14	14,500	700	0.05	0.19	10,500	550	0.04	0.12	10,500	500	0.04	0.12	10,500	470	0.025	0.1
2015-160		16	13,000	650	0.04	0.16	10,000	550	0.03	0.12	8,850	400	0.03	0.12	8,850	390	0.02	0.08
2015-180		18	12,000	580	0.03	0.15	10,000	510	0.025	0.1	8,500	350	0.018	0.09	8,500	360	0.014	0.07
2015-200		20	10,500	530	0.02	0.1	9,200	470	0.02	0.1	8,000	320	0.012	0.06	8,000	320	0.012	0.06
2015-220		22	10,000	500	0.015	0.075	9,000	460	0.015	0.075	7,500	270	0.01	0.05	7,500	270	0.008	0.04
2015-250		25	9,000	440	0.014	0.07	8,750	440	0.014	0.07	7,250	250	0.008	0.04	7,250	250	0.006	0.03
2015-300		30	8,500	420	0.012	0.06	8,500	420	0.012	0.06	7,000	130	0.006	0.03	7,000	130	0.004	0.02
2016-040	R0.8	4	30,000	2,000	0.16	0.48	30,000	1,600	0.12	0.24	30,000	1,800	0.12	0.36	18,000	1,400	0.1	0.2
2016-080		8	30,000	1,700	0.15	0.45	15,000	1,100	0.1	0.2	30,000	1,500	0.12	0.24	13,500	1,000	0.08	0.24
2016-120		12	23,000	1,200	0.1	0.3	11,000	700	0.06	0.18	18,000	1,000	0.06	0.18	12,500	650	0.04	0.16
2016-160		16	15,000	800	0.05	0.2	10,000	530	0.034	0.13	10,000	530	0.035	0.14	9,000	420	0.02	0.1
2016-200		20	11,000	580	0.034	0.17	9,400	490	0.025	0.12	8,500	400	0.018	0.09	7,800	380	0.014	0.07
2018-040	R0.9	4	30,000	2,000	0.18	0.54	30,000	1,800	0.16	0.32	30,000	1,900	0.16	0.48	16,000	1,300	0.14	0.28
2018-060		6	30,000	1,800	0.18	0.52	24,000	1,500	0.15	0.29	30,000	1,700	0.16	0.4	14,000	1,200	0.13	0.27
2018-080		8	30,000	1,800	0.17	0.5	18,000	1,200	0.13	0.26	30,000	1,700	0.16	0.32	12,000	1,000	0.11	0.26
2018-100		10	30,000	1,800	0.16	0.48	15,000	1,100	0.11	0.23	24,000	1,400	0.12	0.28	12,000	900	0.09	0.23
2018-120		12	24,000	1,450	0.12	0.36	13,000	1,000	0.08	0.2	18,000	1,100	0.09	0.23	12,000	750	0.07	0.21
2018-160		16	15,000	900	0.07	0.3	12,000	750	0.05	0.18	15,000	750	0.04	0.14	9,500	480	0.025	0.11
2018-180		18	13,000	800	0.06	0.24	11,000	650	0.04	0.16	11,000	600	0.035	0.14	8,800	440	0.02	0.1
2018-200		20	11,500	650	0.05	0.2	9,500	600	0.03	0.15	8,500	450	0.025	0.11	8,300	420	0.018	0.08
2018-220		22	10,000	590	0.035	0.18	8,500	550	0.03	0.14	8,000	400	0.02	0.1	7,800	400	0.015	0.075
2018-250		25	8,000	500	0.035	0.17	8,000	480	0.025	0.12	7,000	350	0.018	0.09	7,000	350	0.012	0.06
2018-300		30	7,500	450	0.025	0.13	7,500	420	0.02	0.08	6,500	280	0.014	0.07	6,500	280	0.008	0.04

Next Page ➡

Milling Conditions for CSELB

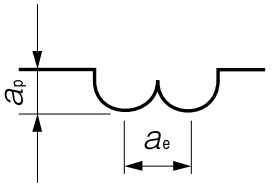
WORK MATERIAL			COPPER / ALUMINUM ALLOYS				CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB)				PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC)				HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2020-030	R1	3	30,000	2,000	0.2	0.6	30,000	2,000	0.21	0.42	30,000	2,000	0.2	0.6	16,000	1,300	0.17	0.5
2020-040		4	30,000	2,000	0.2	0.6	30,000	2,000	0.21	0.42	30,000	2,000	0.2	0.6	16,000	1,300	0.17	0.5
2020-060		6	30,000	2,000	0.2	0.6	30,000	2,000	0.21	0.42	30,000	2,000	0.2	0.6	14,000	1,100	0.15	0.4
2020-080		8	30,000	2,000	0.2	0.6	30,000	2,000	0.18	0.36	30,000	2,000	0.16	0.56	12,000	950	0.12	0.4
2020-100		10	30,000	2,000	0.2	0.6	30,000	2,000	0.14	0.42	30,000	2,000	0.13	0.45	10,800	850	0.1	0.4
2020-120		12	30,000	2,000	0.18	0.54	30,000	2,000	0.12	0.36	30,000	2,000	0.1	0.35	10,800	850	0.08	0.32
2020-130		13	26,000	1,700	0.17	0.52	26,000	1,700	0.11	0.34	25,000	1,600	0.09	0.3	10,800	850	0.07	0.28
2020-140		14	22,000	1,450	0.15	0.5	22,000	1,450	0.11	0.33	20,000	1,300	0.08	0.24	10,800	850	0.06	0.24
2020-160		16	15,000	1,000	0.1	0.4	15,000	1,000	0.07	0.28	10,800	700	0.06	0.18	10,800	600	0.03	0.15
2020-180		18	13,500	900	0.08	0.32	13,500	900	0.06	0.24	9,700	600	0.05	0.15	9,700	520	0.025	0.12
2020-200		20	12,000	800	0.07	0.28	12,000	800	0.05	0.2	8,650	500	0.04	0.16	8,650	450	0.02	0.1
2020-220		22	10,500	700	0.05	0.25	10,500	700	0.04	0.2	8,200	470	0.03	0.12	8,200	440	0.018	0.09
2020-250		25	9,000	600	0.04	0.2	9,000	600	0.035	0.17	7,800	440	0.025	0.1	7,800	440	0.016	0.08
2020-300		30	7,000	470	0.035	0.17	7,000	470	0.03	0.15	7,000	350	0.02	0.08	7,000	350	0.01	0.05
2020-350		35	6,500	430	0.03	0.15	6,500	430	0.025	0.12	6,150	250	0.015	0.06	6,150	250	0.008	0.04
2020-400		40	6,500	430	0.02	0.1	6,500	430	0.02	0.1	5,250	150	0.01	0.05	5,250	150	0.006	0.03
2025-060	R1.25	6	27,000	2,300	0.28	0.75	27,000	2,300	0.25	0.5	27,000	2,300	0.25	0.75	13,000	1,100	0.21	0.63
2025-080		8	27,000	2,300	0.28	0.75	27,000	2,300	0.25	0.5	27,000	2,300	0.25	0.75	13,000	1,100	0.21	0.63
2025-100		10	25,000	2,100	0.26	0.67	25,000	2,100	0.23	0.46	24,000	2,200	0.2	0.65	11,000	930	0.14	0.44
2025-150		15	22,000	1,950	0.23	0.59	22,000	1,950	0.15	0.45	20,000	1,600	0.13	0.42	9,000	720	0.08	0.32
2025-200		20	11,000	1,150	0.14	0.38	11,000	1,150	0.1	0.3	8,000	600	0.06	0.24	7,600	470	0.04	0.12
2025-250		25	8,300	1,000	0.09	0.27	8,300	1,000	0.06	0.24	6,200	450	0.045	0.18	5,800	400	0.03	0.1
2025-300		30	7,000	700	0.06	0.24	7,000	700	0.05	0.2	5,000	380	0.03	0.12	4,800	360	0.022	0.088
2025-350		35	5,500	530	0.04	0.2	5,500	530	0.035	0.17	4,200	300	0.025	0.1	4,200	270	0.015	0.06
2030-060	R1.5	6	24,000	2,500	0.32	0.9	24,000	2,500	0.32	0.9	24,000	2,500	0.3	0.9	14,000	1,400	0.25	0.76
2030-080		8	24,000	2,500	0.32	0.9	24,000	2,500	0.32	0.9	24,000	2,500	0.3	0.9	14,000	1,400	0.25	0.76
2030-100		10	22,000	2,300	0.28	0.8	22,000	2,300	0.28	0.8	24,000	2,500	0.25	0.75	13,000	1,200	0.25	0.76
2030-120		12	22,000	2,300	0.28	0.7	22,000	2,300	0.28	0.7	20,000	2,100	0.2	0.65	10,700	1,000	0.18	0.54
2030-140		14	20,000	2,100	0.24	0.6	20,000	2,100	0.24	0.6	18,000	1,850	0.18	0.5	9,400	800	0.16	0.48
2030-150		15	20,000	2,100	0.24	0.6	20,000	2,100	0.24	0.6	17,000	1,750	0.17	0.5	9,200	750	0.14	0.42
2030-160		16	20,000	2,100	0.24	0.6	20,000	2,100	0.24	0.6	16,000	1,650	0.16	0.5	9,000	700	0.14	0.42
2030-200		20	14,000	1,800	0.2	0.45	14,000	1,800	0.2	0.45	11,000	1,000	0.12	0.36	7,000	600	0.1	0.3
2030-250		25	8,000	1,250	0.16	0.32	8,000	1,250	0.16	0.32	6,400	510	0.08	0.24	5,600	390	0.06	0.18
2030-300		30	6,000	1,000	0.1	0.3	6,000	1,000	0.1	0.3	4,600	450	0.05	0.2	3,900	370	0.04	0.12
2030-350		35	5,500	800	0.07	0.28	5,500	800	0.07	0.28	3,300	320	0.04	0.16	2,900	270	0.03	0.1
2030-400		40	4,500	700	0.05	0.25	4,500	700	0.05	0.25	2,700	240	0.03	0.12	2,300	210	0.02	0.08
2035-100	R1.75	10	24,000	2,700	0.35	1	24,000	2,700	0.35	1	21,000	2,400	0.35	1	12,000	1,700	0.3	0.9
2035-150		15	20,000	2,200	0.29	0.8	20,000	2,200	0.29	0.8	17,000	2,000	0.25	0.7	9,100	1,000	0.19	0.57
2035-200		20	15,000	1,800	0.24	0.6	15,000	1,800	0.24	0.6	12,000	1,450	0.14	0.45	6,800	600	0.13	0.39
2035-250		25	10,000	1,600	0.2	0.47	10,000	1,600	0.2	0.47	8,500	950	0.12	0.34	6,000	540	0.09	0.27
2035-300		30	6,900	1,200	0.18	0.36	6,900	1,200	0.18	0.36	5,500	480	0.09	0.24	4,800	380	0.06	0.18
2035-400		40	4,500	780	0.07	0.3	4,500	780	0.07	0.3	3,000	310	0.04	0.18	2,800	260	0.035	0.11
2035-450		45	3,900	680	0.06	0.26	3,900	680	0.06	0.26	2,300	240	0.03	0.14	2,000	200	0.025	0.1

Next Page ➡

Milling Conditions for CSELB

WORK MATERIAL			COPPER / ALUMINUM ALLOYS				CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB)				PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC)				HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2040-080	R2	8	24,000	2,900	0.4	1.2	24,000	2,900	0.4	1.2	18,000	2,400	0.4	1.2	11,000	2,000	0.34	1
2040-100		10	24,000	2,900	0.4	1.2	24,000	2,900	0.4	1.2	18,000	2,400	0.4	1.2	11,000	2,000	0.34	1
2040-120		12	24,000	2,900	0.4	1.2	24,000	2,900	0.4	1.2	18,000	2,400	0.4	1.2	9,700	1,500	0.28	0.85
2040-140		14	21,000	2,630	0.35	1.1	21,000	2,630	0.35	1.1	15,000	2,150	0.3	1.1	9,700	1,200	0.28	0.8
2040-150		15	19,000	2,350	0.32	1	19,000	2,350	0.32	1	15,000	2,150	0.3	1	8,800	1,100	0.24	0.7
2040-160		16	18,000	2,250	0.3	1	18,000	2,250	0.3	1	15,000	2,150	0.3	0.9	8,000	1,000	0.2	0.6
2040-200		20	15,000	1,900	0.3	0.9	15,000	1,900	0.3	0.9	12,000	1,750	0.2	0.7	7,000	750	0.15	0.45
2040-250		25	12,000	1,550	0.25	0.7	12,000	1,550	0.25	0.7	9,000	1,300	0.15	0.5	6,000	560	0.12	0.36
2040-300		30	7,000	1,400	0.2	0.5	7,000	1,400	0.2	0.5	7,000	850	0.1	0.3	5,000	460	0.08	0.2
2040-350		35	6,000	1,200	0.2	0.4	6,000	1,200	0.2	0.4	4,800	450	0.1	0.25	4,000	370	0.07	0.17
2040-400		40	4,000	1,000	0.11	0.33	4,000	1,000	0.11	0.33	3,450	400	0.06	0.24	2,900	270	0.06	0.15
2040-450		45	3,800	760	0.08	0.32	3,800	760	0.08	0.32	2,700	300	0.05	0.2	2,300	240	0.04	0.12
2040-500		50	3,400	680	0.07	0.28	3,400	680	0.07	0.28	2,000	240	0.04	0.16	1,700	190	0.03	0.12
2040-600		60	3,000	600	0.05	0.2	3,000	600	0.05	0.2	1,800	220	0.03	0.12	1,600	170	0.02	0.08
2050-100	R2.5	10	18,000	3,000	0.5	1.5	18,000	3,000	0.5	1.5	13,750	2,400	0.45	1.4	8,800	1,800	0.42	1.2
2050-150		15	18,000	3,000	0.5	1.5	18,000	3,000	0.5	1.5	13,750	2,400	0.45	1.4	7,800	1,300	0.34	1
2050-200		20	14,000	2,600	0.37	1.2	15,600	2,600	0.37	1.2	12,000	1,800	0.36	1.1	6,300	830	0.27	0.75
2050-250		25	12,000	2,000	0.33	1.1	12,000	2,000	0.33	1.1	9,600	1,350	0.25	1	5,700	750	0.25	0.67
2050-300		30	9,600	1,800	0.31	0.9	9,600	1,800	0.31	0.9	8,400	1,100	0.23	0.8	5,000	650	0.2	0.5
2050-350		35	8,400	1,700	0.3	0.75	8,400	1,700	0.3	0.75	7,200	850	0.2	0.6	4,400	530	0.16	0.33
2050-400		40	5,500	1,500	0.25	0.5	4,800	1,500	0.25	0.5	3,800	440	0.13	0.35	3,300	390	0.09	0.22
2050-450		45	4,000	1,200	0.2	0.42	4,000	1,200	0.2	0.42	3,300	400	0.11	0.3	2,800	330	0.08	0.18
2050-500		50	3,200	1,000	0.16	0.37	3,200	1,000	0.16	0.37	2,750	350	0.08	0.27	2,350	270	0.07	0.15
2060-100	R3	10	16,000	3,100	0.6	1.8	16,000	3,100	0.6	1.8	11,000	2,310	0.55	1.7	7,500	1,800	0.5	1.5
2060-150		15	16,000	3,100	0.6	1.8	16,000	3,100	0.6	1.8	11,000	2,310	0.55	1.7	7,500	1,800	0.5	1.5
2060-200		20	16,000	3,100	0.6	1.8	16,000	3,100	0.6	1.8	11,000	2,310	0.55	1.7	6,500	1,300	0.4	1.4
2060-250		25	13,000	2,600	0.45	1.5	13,000	2,600	0.45	1.5	10,000	1,800	0.4	1.3	5,300	840	0.32	0.9
2060-300		30	10,000	2,100	0.4	1.3	10,000	2,100	0.4	1.3	8,000	1,350	0.3	1.1	4,700	750	0.3	0.8
2060-350		35	8,000	1,800	0.38	1.1	8,000	1,800	0.38	1.1	7,000	1,100	0.26	0.9	4,200	670	0.25	0.6
2060-400		40	7,000	1,800	0.36	0.9	7,000	1,800	0.36	0.9	6,000	900	0.23	0.75	3,700	550	0.2	0.4
2060-450		45	5,800	1,700	0.33	0.75	5,800	1,700	0.33	0.75	4,600	670	0.19	0.6	3,200	470	0.15	0.3
2060-500		50	4,000	1,500	0.3	0.6	4,000	1,500	0.3	0.6	3,200	450	0.15	0.4	2,800	400	0.1	0.2
2060-600		60	2,700	1,000	0.21	0.42	2,700	1,000	0.21	0.42	2,300	320	0.1	0.3	1,950	270	0.08	0.16

Note:
- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when burr and red-hot occur.
- Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
- Recommend wet coolant for Copper.



a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

2 Flutes UTCOAT

Size **R0.5~R1**

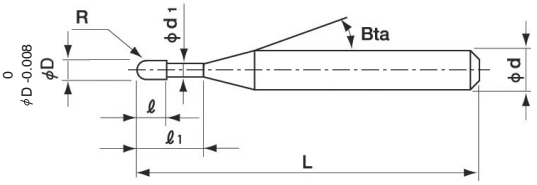
HGLB

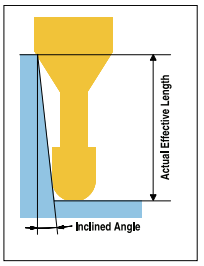
Super MG | HMG COAT | 30° | R ±0.003 | Shank Dia 0/-0.004

NEW

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS ~55HRC	HARDENED STEELS ~60HRC	HARDENED STEELS ~70HRC	CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE	HARD BRITTLE (NON-METALLIC) MATERIALS
		○	◎	◎	◎										





The shank taper angle shown is not an exact value and to avoid contact with the workpiece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 18 models Unit (mm)

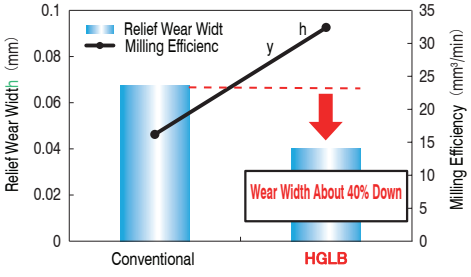
Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles 30'	1°	1°30'	2°	3°
HGLB 2010-020	R0.5	2	0.8	0.98	16°	45	4	2.18	2.24	2.30	2.36	2.51
HGLB 2010-025		2.5				45	4	2.70	2.77	2.85	2.93	3.12
HGLB 2010-040		4				45	4	4.24	4.37	4.50	4.64	4.96
HGLB 2010-060		6.0				45	4	6.31	6.50	6.70	6.92	7.40
HGLB 2010-080		8				45	4	8.37	8.63	8.90	9.20	9.85
HGLB 2010-100		10				45	4	10.43	10.76	11.10	11.47	12.30
HGLB 2015-030	R0.75	3	1.2	1.47	16°	45	4	3.10	3.18	3.26	3.35	3.55
HGLB 2015-040		4				45	4	4.13	4.24	4.36	4.49	4.77
HGLB 2015-060		6				45	4	6.19	6.37	6.56	6.76	7.22
HGLB 2015-080		8				45	4	8.25	8.50	8.76	9.04	9.97
HGLB 2015-100		10				45	4	10.32	10.63	10.96	11.32	12.11
HGLB 2015-120		12				45	4	12.38	12.76	13.16	13.60	14.56
HGLB 2020-030	R1	3	1.6	1.98	16°	45	4	3.07	3.14	3.21	3.29	3.47
HGLB 2020-040		4				45	4	4.10	4.20	4.31	4.43	4.70
HGLB 2020-060		6				45	4	6.16	6.33	6.51	6.71	7.14
HGLB 2020-080		8				45	4	8.23	8.46	8.72	8.99	9.59
HGLB 2020-120		12				45	4	12.35	12.72	13.12	13.54	14.48
HGLB 2020-160		16				45	4	16.48	16.98	17.52	18.10	19.38

Wear Comparison HGLB R1 × 6mm Effective Length HAP72 (69HRC)

Tools after milling

Conventional

HGLB



HGLB mills twice as efficient as the conventional tool.

Tool	Conventional	HGLB 2020-060
Spindle Speed	9,200 min^{-1}	12,250 min^{-1}
Feed Rate	900 mm/min	1,800 mm/min
Axial Depth a_p	0.06 mm	
Radial Depth a_e	0.3 mm	
Coolant	Air Blow (Through-Spindle)	
Milling Shape	Square Pocket (20 x 15 x Depth 2 mm) × 2 Pockets	
Cycle Time	76 min	50 min

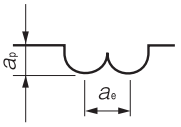
Milling Efficiency (mm^3/min) = Feed Rate × a_p × a_e

WORK MATERIAL			PREHARDENED STEELS / HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Radius of Ball Nose (mm)	Length of Cut (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2010-0150	**R0.5**	1.5	30,000	1,750	0.2	0.4	24,000	2,000	0.1	0.3	21,000	1,750	0.05	0.2	16,000	875	0.05	0.2
2015-0225	**R0.75**	2.25	30,000	2,450	0.25	0.55	17,000	2,000	0.12	0.4	15,000	1,750	0.06	0.29	11,250	875	0.06	0.29
2020-0300	**R1**	3	28,000	2,900	0.3	0.7	14,000	2,100	0.15	0.5	14,700	2,160	0.1	0.35	11,040	1,080	0.08	0.35
2025-0375	**R1.25**	3.75	24,500	2,950	0.35	0.85	12,250	2,150	0.17	0.6	12,840	2,220	0.12	0.45	9,660	1,110	0.1	0.45
2030-0450	**R1.5**	4.5	21,000	3,000	0.4	1	10,500	2,200	0.2	0.7	11,040	2,280	0.15	0.55	8,280	1,140	0.12	0.55
2040-0600	**R2**	6	18,000	3,200	0.5	1.3	9,000	2,300	0.25	0.95	9,480	2,400	0.18	0.75	7,080	1,200	0.15	0.75
2050-0750	**R2.5**	7.5	15,600	3,500	0.5	1.5	7,800	2,500	0.25	1.05	8,160	2,520	0.2	0.85	6,120	1,260	0.15	0.85
2060-0900	**R3**	9	13,000	3,500	0.6	1.8	6,500	2,500	0.3	1.3	6,840	2,640	0.25	1	5,000	1,500	0.2	1

Milling Conditions

WORK MATERIAL			PREHARDENED STEELS / HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2010-020	**R0.5**	2	30,000	1,750	0.2	0.4	24,000	2,000	0.1	0.3	21,000	1,750	0.05	0.2	16,000	875	0.05	0.2
2010-025		2.5	30,000	1,750	0.2	0.4	24,000	2,000	0.1	0.3	21,000	1,750	0.05	0.2	16,000	875	0.05	0.2
2010-040		4	30,000	1,750	0.1	0.3	24,000	2,000	0.1	0.2	21,000	1,750	0.03	0.17	16,000	875	0.03	0.17
2010-060		6	30,000	1,150	0.06	0.23	21,500	1,250	0.03	0.17	19,700	1,050	0.025	0.15	14,500	525	0.025	0.15
2010-080		8	24,000	800	0.025	0.155	18,500	580	0.015	0.12	18,400	480	0.015	0.12	13,800	240	0.015	0.12
2010-100		10	22,000	600	0.018	0.13	14,800	430	0.01	0.09	14,700	360	0.01	0.09	14,700	360	0.01	0.09
2015-030	**R0.75**	3	30,000	2,450	0.25	0.55	17,000	2,000	0.12	0.4	15,000	1,750	0.06	0.29	11,250	875	0.06	0.29
2015-040		4	30,000	2,450	0.25	0.55	17,000	2,000	0.12	0.4	15,000	1,750	0.06	0.29	11,250	875	0.06	0.29
2015-060		6	30,000	2,450	0.15	0.45	17,000	2,000	0.07	0.31	15,000	1,750	0.04	0.24	11,250	875	0.04	0.24
2015-080		8	23,500	1,300	0.1	0.37	15,000	1,250	0.045	0.25	14,000	1,050	0.03	0.21	10,500	525	0.03	0.21
2015-100		10	23,500	1,300	0.1	0.37	15,000	1,250	0.045	0.25	14,000	1,050	0.03	0.17	10,500	525	0.03	0.21
2015-120		12	13,100	480	0.03	0.21	13,000	580	0.02	0.17	13,000	480	0.02	0.17	9,750	240	0.02	0.17
2020-030	**R1**	3	28,000	2,900	0.3	0.7	14,000	2,100	0.15	0.5	14,700	2,100	0.15	0.35	12,250	1,800	0.08	0.35
2020-040		4	28,000	2,900	0.3	0.7	14,000	2,100	0.15	0.5	14,700	2,100	0.15	0.35	12,250	1,800	0.08	0.35
2020-060		6	28,000	2,900	0.2	0.6	14,000	2,100	0.1	0.4	14,700	2,100	0.15	0.3	12,250	1,800	0.06	0.3
2020-080		8	28,000	2,900	0.2	0.6	14,000	2,100	0.1	0.4	14,700	2,100	0.15	0.3	12,250	1,800	0.06	0.3
2020-120		12	19,500	1,350	0.12	0.45	12,400	1,350	0.06	0.34	13,800	1,320	0.09	0.27	11,500	1,100	0.045	0.27
2020-160		16	10,800	500	0.05	0.3	10,800	600	0.03	0.24	12,840	588	0.06	0.24	10,700	490	0.03	0.24

Note:
- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when chattering and red-hot occur.
- Every coolant offers stable milling.



a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

Size R0.05~R3

HSLB

Super MG | HARD MAX | Shank Dia 0/-0.005 | Back Taper Geometry

~Except for R0.45
ℓ1 / D≤ 10

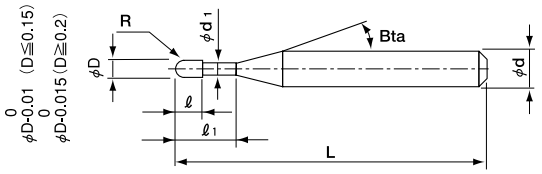
Additional 16 models

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
○	○	◎	◎	◎	◎	○			○			○	○		

Features

Offers high efficiency, long tool life and excellent surface finish on material 40HRC or harder.
New and harder HARDMAX coat is adopted maintaining heat resistance, durability and lubricity at a high level.
Every coolant offers stable milling.
Ball tip radius point is designed with a negative rake angle that minimizes wear and improves the target dimensions.
The low negative rake angle at the peripheral side of the ball offers an excellent surface finish and prevents deflection.



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Radius of Ball Nose	Diameter Tolerance	Ballend Radius Tolerance	Helix Angle
R0.05 ~ R0.075	0/-0.01	R ±0.003	0°
R0.1 ~ R3	0/-0.015	R ±0.005	30°

Total 309 models

Unit (mm)

	Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles 30'	1°	1°30'	2°	3°
※	HSLB 2001-002	R0.05	0.2	0.08	0.095	11°	45	4	0.21	0.23	0.25	0.27	0.31
	HSLB 2001-003		0.3				45	4	0.32	0.35	0.37	0.40	0.45
	HSLB 2001-005		0.5				45	4	0.54	0.57	0.61	0.64	0.72
	HSLB 20015-003	R0.075	0.3	0.12	0.135	11°	45	4	0.36	0.38	0.40	0.42	0.47
	HSLB 20015-005		0.5				45	4	0.57	0.60	0.63	0.67	0.75
	HSLB 20015-010		1				45	4	1.10	1.15	1.21	1.27	1.43
	HSLB 2002-003	R0.1	0.3	0.16	0.19	16°	45	4	0.39	0.42	0.44	0.46	0.50
	HSLB 2002-005		0.5				45	4	0.61	0.64	0.66	0.69	0.74
	HSLB 2002-005-6		0.5				50	6	0.61	0.64	0.66	0.69	0.74
	HSLB 2002-0075		0.75				45	4	0.87	0.91	0.95	0.98	1.05
	HSLB 2002-010		1				45	4	1.13	1.18	1.22	1.26	1.35
	HSLB 2002-010-6		1				50	6	1.13	1.18	1.22	1.26	1.35
※	HSLB 2002-0125		1.25				45	4	1.38	1.44	1.49	1.54	1.65
	HSLB 2002-015		1.5				45	4	1.64	1.71	1.76	1.82	1.96
※	HSLB 2002-0175		1.75				45	4	1.90	1.97	2.04	2.11	2.26
	HSLB 2002-020		2				45	4	2.16	2.24	2.31	2.39	2.57
※	HSLB 2002-0225		2.25				45	4	2.42	2.51	2.59	2.68	2.87
	HSLB 2002-025		2.5				45	4	2.68	2.77	2.86	2.96	3.18
	HSLB 2002-030		3				45	4	3.20	3.30	3.41	3.53	3.79

※ Additional model

Next Page ➡

Unit (mm)

	Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
									30'	1°	1°30'	2°	3°
	HSLB 2003-005	R0.15	0.5	0.24	0.29	16°	45	4	0.60	0.63	0.66	0.68	0.73
	HSLB 2003-006		0.6				45	4	0.71	0.74	0.77	0.80	0.85
	HSLB 2003-0075		0.75				45	4	0.87	0.91	0.94	0.97	1.04
	HSLB 2003-010		1				45	4	1.13	1.18	1.22	1.26	1.34
	HSLB 2003-010-6		1				50	6	1.13	1.18	1.22	1.26	1.34
※	HSLB 2003-0125		1.25				45	4	1.38	1.43	1.48	1.53	1.64
	HSLB 2003-015		1.5				45	4	1.64	1.70	1.76	1.82	1.94
	HSLB 2003-015-6		1.5				50	6	1.64	1.70	1.76	1.82	1.94
※	HSLB 2003-0175		1.75				45	4	1.90	1.97	2.03	2.10	2.25
	HSLB 2003-020		2				45	4	2.16	2.24	2.31	2.38	2.56
	HSLB 2003-020-6		2				50	6	2.16	2.24	2.31	2.38	2.56
※	HSLB 2003-0225		2.25				45	4	2.42	2.50	2.58	2.67	2.86
	HSLB 2003-025		2.5				45	4	2.68	2.77	2.86	2.95	3.17
	HSLB 2003-030		3				45	4	3.20	3.30	3.41	3.52	3.78
	HSLB 2003-040		4				45	4	4.23	4.37	4.51	4.66	5.00
	HSLB 2003-050		5				45	4	5.26	5.43	5.61	5.80	6.23
	HSLB 2004-005	R0.2	0.5	0.32	0.39	16°	45	4	0.60	0.63	0.65	0.68	0.72
	HSLB 2004-0075		0.75				45	4	0.86	0.90	0.93	0.96	1.03
	HSLB 2004-010		1				45	4	1.13	1.17	1.21	1.25	1.33
	HSLB 2004-010-6		1				50	6	1.13	1.17	1.21	1.25	1.33
※	HSLB 2004-0125		1.25				45	4	1.37	1.43	1.48	1.52	1.63
	HSLB 2004-015		1.5				45	4	1.64	1.70	1.75	1.81	1.93
	HSLB 2004-015-6		1.5				50	6	1.64	1.70	1.75	1.81	1.93
※	HSLB 2004-0175		1.75				45	4	1.90	1.97	2.03	2.09	2.24
	HSLB 2004-020		2				45	4	2.16	2.23	2.30	2.38	2.55
	HSLB 2004-020-6		2				50	6	2.16	2.23	2.30	2.38	2.55
※	HSLB 2004-0225		2.25				45	4	2.42	2.50	2.58	2.66	2.85
	HSLB 2004-025		2.5				45	4	2.68	2.76	2.85	2.95	3.16
	HSLB 2004-025-6		2.5				50	6	2.68	2.76	2.85	2.95	3.16
	HSLB 2004-030		3				45	4	3.20	3.30	3.40	3.52	3.77
	HSLB 2004-030-6		3				50	6	3.20	3.30	3.40	3.52	3.77
	HSLB 2004-035		3.5				45	4	3.71	3.83	3.95	4.09	4.38
	HSLB 2004-040		4				45	4	4.23	4.36	4.50	4.66	4.99
	HSLB 2004-040-6		4				50	6	4.23	4.36	4.50	4.66	4.99
	HSLB 2004-045		4.5				45	4	4.74	4.89	5.05	5.22	5.61
	HSLB 2004-050		5				45	4	5.26	5.43	5.60	5.79	6.22
	HSLB 2004-060		6				45	4	6.29	6.49	6.70	6.93	7.44

※Additional model

Next Page ➡

2 Flutes HARDMAX

Unit (mm)

	Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
									30'	1°	1°30'	2°	3°
	HSLB 2005-010		1				45	4	1.12	1.17	1.21	1.24	1.32
※	HSLB 2005-0125		1.25				45	4	1.37	1.43	1.47	1.52	1.62
	HSLB 2005-015		1.5				45	4	1.63	1.70	1.75	1.80	1.92
	HSLB 2005-015-6		1.5				50	6	1.63	1.70	1.75	1.80	1.92
※	HSLB 2005-0175		1.75				45	4	1.90	1.96	2.02	2.09	2.23
	HSLB 2005-020		2				45	4	2.16	2.23	2.30	2.37	2.54
	HSLB 2005-020-6		2				50	6	2.16	2.23	2.30	2.37	2.54
※	HSLB 2005-0225		2.25				45	4	2.42	2.50	2.57	2.66	2.84
	HSLB 2005-025		2.5				45	4	2.68	2.76	2.85	2.94	3.15
	HSLB 2005-025-6		2.5				50	6	2.68	2.76	2.85	2.94	3.15
	HSLB 2005-030		3				45	4	3.20	3.29	3.40	3.51	3.76
	HSLB 2005-030-6	R0.25	3	0.4	0.49	16°	50	6	3.20	3.29	3.40	3.51	3.76
	HSLB 2005-035		3.5				45	4	3.71	3.83	3.95	4.08	4.37
	HSLB 2005-040		4				45	4	4.23	4.36	4.50	4.65	4.98
	HSLB 2005-040-6		4				50	6	4.23	4.36	4.50	4.65	4.98
	HSLB 2005-045		4.5				45	4	4.74	4.89	5.05	5.22	5.59
	HSLB 2005-050		5				45	4	5.26	5.42	5.60	5.79	6.21
	HSLB 2005-055		5.5				45	4	5.77	5.96	6.15	6.36	6.82
	HSLB 2005-060		6				45	4	6.29	6.49	6.70	6.93	7.43
	HSLB 2005-070		7				45	4	7.32	7.55	7.80	8.06	8.65
	HSLB 2005-080		8				45	4	8.35	8.62	8.90	9.20	9.88
	HSLB 2005-090		9				45	4	9.38	9.68	10.00	10.34	11.10
	HSLB 2005-100		10				50	4	10.42	10.75	11.10	11.48	12.32
	HSLB 2006-010		1				45	4	1.12	1.16	1.20	1.24	1.31
※	HSLB 2006-0125		1.25				45	4	1.37	1.42	1.47	1.51	1.61
	HSLB 2006-015		1.5				45	4	1.63	1.69	1.74	1.80	1.91
	HSLB 2006-015-6		1.5				50	6	1.63	1.69	1.74	1.80	1.91
※	HSLB 2006-0175		1.75				45	4	1.89	1.96	2.02	2.08	2.22
	HSLB 2006-020		2				45	4	2.15	2.23	2.29	2.36	2.52
	HSLB 2006-020-6		2				50	6	2.15	2.23	2.29	2.36	2.52
※	HSLB 2006-0225		2.25				45	4	2.42	2.49	2.57	2.65	2.83
	HSLB 2006-025		2.5				45	4	2.67	2.76	2.84	2.93	3.14
	HSLB 2006-025-6		2.5				50	6	2.67	2.76	2.84	2.93	3.14
	HSLB 2006-030		3				45	4	3.19	3.29	3.39	3.50	3.75
	HSLB 2006-030-6		3				50	6	3.19	3.29	3.39	3.50	3.75
	HSLB 2006-035		3.5				45	4	3.71	3.82	3.94	4.07	4.36
	HSLB 2006-040		4				45	4	4.23	4.36	4.49	4.64	4.97
	HSLB 2006-040-6	R0.3	4	0.48	0.59	16°	50	6	4.23	4.36	4.49	4.64	4.97
	HSLB 2006-045		4.5				45	4	4.74	4.89	5.04	5.21	5.58
	HSLB 2006-050		5				45	4	5.26	5.42	5.59	5.78	6.20
	HSLB 2006-050-6		5				50	6	5.26	5.42	5.59	5.78	6.20
	HSLB 2006-055		5.5				45	4	5.77	5.95	6.14	6.35	6.81
	HSLB 2006-060		6				45	4	6.29	6.49	6.69	6.92	7.42
	HSLB 2006-060-6		6				50	6	6.29	6.49	6.69	6.92	7.42
	HSLB 2006-065		6.5				45	4	6.80	7.02	7.25	7.49	8.03
	HSLB 2006-070		7				45	4	7.32	7.55	7.80	8.06	8.64
	HSLB 2006-080		8				45	4	8.35	8.61	8.90	9.20	9.87
	HSLB 2006-080-6		8				50	6	8.35	8.61	8.90	9.20	9.87
	HSLB 2006-090		9				45	4	9.38	9.68	10.00	10.34	11.09
	HSLB 2006-100		10				50	4	10.41	10.74	11.10	11.47	12.31
	HSLB 2006-100-6		10				50	6	10.41	10.74	11.10	11.47	12.31
	HSLB 2006-120		12				50	4	12.48	12.87	13.30	13.75	14.76

※ Additional model

Next Page ➡

Unit (mm)

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
HSLB 2007-020	R0.35	2	0.56	0.69	16°	45	4	2.15	2.22	2.29	2.36	2.51
HSLB 2007-040		4				45	4	4.22	4.35	4.49	4.63	4.96
HSLB 2007-060		6				45	4	6.29	6.48	6.69	6.91	7.41
HSLB 2007-080		8				45	4	8.35	8.61	8.89	9.19	9.86
HSLB 2008-020	R0.4	2	0.64	0.79	16°	45	4	2.15	2.22	2.28	2.35	2.50
HSLB 2008-020-6		2				50	6	2.15	2.22	2.28	2.35	2.50
HSLB 2008-030		3				45	4	3.19	3.28	3.38	3.49	3.73
HSLB 2008-030-6		3				50	6	3.19	3.28	3.38	3.49	3.73
HSLB 2008-040		4				45	4	4.22	4.35	4.48	4.63	4.95
HSLB 2008-040-6		4				50	6	4.22	4.35	4.48	4.63	4.95
HSLB 2008-050		5				45	4	5.25	5.41	5.58	5.77	6.17
HSLB 2008-060		6				45	4	6.29	6.48	6.68	6.91	7.40
HSLB 2008-060-6		6				50	6	6.29	6.48	6.68	6.91	7.40
HSLB 2008-070		7				45	4	7.32	7.54	7.79	8.04	8.62
HSLB 2008-080		8				45	4	8.35	8.61	8.89	9.18	9.84
HSLB 2008-080-6		8				50	6	8.35	8.61	8.89	9.18	9.84
HSLB 2008-090		9				45	4	9.38	9.67	9.99	10.32	11.07
HSLB 2008-100		10				50	4	10.41	10.74	11.09	11.46	12.29
HSLB 2008-100-6		10				50	6	10.41	10.74	11.09	11.46	12.29
HSLB 2008-120		12				50	4	12.47	12.87	13.29	13.74	14.74
HSLB 2008-160		16				50	4	16.60	17.13	17.69	18.29	19.63
HSLB 2009-020	R0.45	2	0.72	0.89	16°	45	4	2.15	2.22	2.28	2.34	2.49
HSLB 2009-040		4				45	4	4.22	4.35	4.48	4.62	4.94
HSLB 2009-060		6				45	4	6.28	6.48	6.68	6.90	7.39
HSLB 2009-080		8				45	4	8.35	8.61	8.88	9.18	9.83
HSLB 2009-100		10				45	4	10.41	10.73	11.08	11.45	12.28
HSLB 2009-120		12				50	4	12.47	12.86	13.28	13.73	14.73
HSLB 2009-140		14				50	4	14.54	14.99	15.48	16.01	17.18
HSLB 2009-160		16				50	4	16.60	17.12	17.68	18.29	19.62
HSLB 2009-180		18				55	4	18.66	19.25	19.89	20.56	22.07

Next Page ➡

2 Flutes HARDMAX

Unit (mm)

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
HSLB 2010-020	R0.5	2	0.8	0.98	16°	45	4	2.16	2.22	2.28	2.35	2.49
HSLB 2010-025		2.5				45	4	2.68	2.76	2.83	2.92	3.11
HSLB 2010-030		3				45	4	3.20	3.29	3.38	3.49	3.72
HSLB 2010-030-6		3				50	6	3.20	3.29	3.38	3.49	3.72
HSLB 2010-040		4				45	4	4.23	4.35	4.49	4.63	4.94
HSLB 2010-040-6		4				50	6	4.23	4.35	4.49	4.63	4.94
HSLB 2010-050		5				45	4	5.26	5.42	5.59	5.77	6.16
HSLB 2010-050-6		5				50	6	5.26	5.42	5.59	5.77	6.16
HSLB 2010-060		6				45	4	6.29	6.48	6.69	6.90	7.39
HSLB 2010-060-6		6				50	6	6.29	6.48	6.69	6.90	7.39
HSLB 2010-070		7				45	4	7.32	7.55	7.79	8.04	8.61
HSLB 2010-070-6		7				50	6	7.32	7.55	7.79	8.04	8.61
HSLB 2010-080		8				45	4	8.36	8.61	8.89	9.18	9.84
HSLB 2010-080-6		8				50	6	8.36	8.61	8.89	9.18	9.84
HSLB 2010-090		9				45	4	9.39	9.68	9.99	10.32	11.06
HSLB 2010-100		10				45	4	10.42	10.74	11.09	11.46	12.28
HSLB 2010-100-6		10				50	6	10.42	10.74	11.09	11.46	12.28
HSLB 2010-120		12				45	4	12.48	12.87	13.29	13.74	14.73
HSLB 2010-120-6		12				50	6	12.48	12.87	13.29	13.74	14.73
HSLB 2010-140		14				50	4	14.54	15.00	15.49	16.01	17.18
HSLB 2010-140-6		14				60	6	14.54	15.00	15.49	16.01	17.18
HSLB 2010-160		16				50	4	16.61	17.13	17.69	18.29	19.62
HSLB 2010-160-6		16				60	6	16.61	17.13	17.69	18.29	19.62
HSLB 2010-180		18				55	4	18.67	19.26	19.89	20.57	22.07
HSLB 2010-200		20				55	4	20.73	21.39	22.09	22.85	24.52
HSLB 2010-200-6		20				70	6	20.73	21.39	22.09	22.85	24.52
HSLB 2010-220-6		22				70	6	22.80	23.52	24.29	25.12	26.97
HSLB 2012-025	R0.6	2.5	0.96	1.19	16°	45	4	2.54	2.60	2.67	2.74	2.91
HSLB 2012-040		4				45	4	4.08	4.20	4.32	4.45	4.75
HSLB 2012-060		6				45	4	6.15	6.33	6.52	6.73	7.19
HSLB 2012-060-6		6				50	6	6.15	6.33	6.52	6.73	7.19
HSLB 2012-080		8				45	4	8.21	8.46	8.72	9.01	9.64
HSLB 2012-080-6		8				50	6	8.21	8.46	8.72	9.01	9.64
HSLB 2012-100		10				45	4	10.27	10.59	10.92	11.28	12.09
HSLB 2012-100-6		10				50	6	10.27	10.59	10.92	11.28	12.09
HSLB 2012-120		12				45	4	12.33	12.72	13.12	13.56	14.54
HSLB 2012-120-6		12				50	6	12.33	12.72	13.12	13.56	14.54
HSLB 2012-140		14				50	4	14.40	14.85	15.33	15.84	16.98
HSLB 2012-160		16				50	4	16.46	16.98	17.53	18.12	19.43
HSLB 2012-160-6		16				60	6	16.46	16.98	17.53	18.12	19.43
HSLB 2012-180		18				55	4	18.52	19.11	19.73	20.39	21.88
HSLB 2012-200		20				60	4	20.58	21.23	21.93	22.67	24.33

Next Page ➡

Unit（mm）

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
HSLB 2014-060	R0.7	6	1.12	1.37	16°	45	4	6.18	6.36	6.55	6.76	7.22
HSLB 2014-080		8				45	4	8.24	8.49	8.75	9.03	9.66
HSLB 2014-120		12				45	4	12.37	12.75	13.15	13.59	14.56
HSLB 2014-160		16				50	4	16.49	17.01	17.56	18.14	19.45
HSLB 2015-030	R0.75	3	1.2	1.47	16°	45	4	3.08	3.16	3.24	3.33	3.53
HSLB 2015-040		4				45	4	4.11	4.23	4.34	4.47	4.76
HSLB 2015-060		6				45	4	6.18	6.35	6.55	6.75	7.20
HSLB 2015-060-6		6				50	6	6.18	6.35	6.55	6.75	7.20
HSLB 2015-080		8				45	4	8.24	8.48	8.75	9.03	9.65
HSLB 2015-080-6		8				50	6	8.24	8.48	8.75	9.03	9.65
HSLB 2015-100		10				45	4	10.30	10.61	10.95	11.30	12.10
HSLB 2015-100-6		10				50	6	10.30	10.61	10.95	11.30	12.10
HSLB 2015-120		12				45	4	12.37	12.74	13.15	13.58	14.55
HSLB 2015-120-6		12				50	6	12.37	12.74	13.15	13.58	14.55
HSLB 2015-140		14				50	4	14.43	14.87	15.35	15.86	16.99
HSLB 2015-160		16				50	4	16.49	17.00	17.55	18.14	19.44
HSLB 2015-160-6		16				60	6	16.49	17.00	17.55	18.14	19.44
HSLB 2015-180		18				55	4	18.55	19.13	19.75	20.41	21.89
HSLB 2015-200		20				55	4	20.62	21.26	21.95	22.69	24.34
HSLB 2015-200-6		20				60	6	20.62	21.26	21.95	22.69	24.34
HSLB 2015-220		22				55	4	22.68	23.39	24.15	24.97	No Interference
HSLB 2015-250		25				65	4	25.77	26.59	27.45	28.38	No Interference
HSLB 2015-300		30				70	4	30.93	31.91	32.96	34.08	No Interference
HSLB 2016-040	R0.8	4	1.28	1.58	16°	45	4	4.09	4.20	4.32	4.45	4.72
HSLB 2016-080		8				45	4	8.22	8.46	8.72	9.00	9.62
HSLB 2016-120		12				45	4	12.35	12.72	13.12	13.55	14.51
HSLB 2016-160		16				50	4	16.47	16.98	17.53	18.11	19.41
HSLB 2016-200		20				55	4	20.60	21.24	21.93	22.66	No Interference
HSLB 2018-040	R0.9	4	1.44	1.78	16°	45	4	4.09	4.20	4.31	4.43	4.70
HSLB 2018-060		6				45	4	6.15	6.33	6.51	6.71	7.15
HSLB 2018-080		8				45	4	8.22	8.46	8.71	8.99	9.60
HSLB 2018-100		10				45	4	10.28	10.59	10.91	11.26	12.04
HSLB 2018-120		12				45	4	12.34	12.72	13.11	13.54	14.49
HSLB 2018-160		16				50	4	16.47	16.97	17.52	18.10	19.39
HSLB 2018-180		18				55	4	18.53	19.10	19.72	20.37	21.83
HSLB 2018-200		20				55	4	20.59	21.23	21.92	22.65	No Interference
HSLB 2018-220		22				60	4	22.66	23.36	24.12	24.93	No Interference
HSLB 2018-250		25				65	4	25.75	26.56	27.42	28.34	No Interference
HSLB 2018-300		30				70	4	30.91	31.88	32.92	No Interference	No Interference

Next Page ➡

2 Flutes HARDMAX

Unit (mm)

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
HSLB 2020-030	R1	3	1.6	1.98	16°	45	4	3.06	3.13	3.20	3.28	3.46
HSLB 2020-040		4				45	4	4.09	4.19	4.30	4.42	4.68
HSLB 2020-040-6		4				50	6	4.09	4.19	4.30	4.42	4.68
HSLB 2020-060		6				45	4	6.15	6.32	6.50	6.70	7.13
HSLB 2020-060-6		6				50	6	6.15	6.32	6.50	6.70	7.13
HSLB 2020-080		8				45	4	8.21	8.45	8.70	8.97	9.58
HSLB 2020-080-6		8				50	6	8.21	8.45	8.70	8.97	9.58
HSLB 2020-100		10				45	4	10.28	10.58	10.90	11.25	12.02
HSLB 2020-100-6		10				50	6	10.28	10.58	10.90	11.25	12.02
HSLB 2020-120		12				45	4	12.34	12.71	13.10	13.53	14.47
HSLB 2020-120-6		12				50	6	12.34	12.71	13.10	13.53	14.47
HSLB 2020-130		13				45	4	13.37	13.77	14.20	14.67	15.69
HSLB 2020-140		14				50	4	14.40	14.84	15.31	15.80	16.92
HSLB 2020-160		16				50	4	16.46	16.97	17.51	18.08	19.36
HSLB 2020-160-6		16				60	6	16.46	16.97	17.51	18.08	19.36
HSLB 2020-180		18				55	4	18.53	19.10	19.71	20.36	No Interference
HSLB 2020-200		20				55	4	20.59	21.23	21.91	22.64	No Interference
HSLB 2020-200-6		20				70	6	20.59	21.23	21.91	22.64	24.26
HSLB 2020-220		22				60	4	22.65	23.36	24.11	24.91	No Interference
HSLB 2020-250		25				65	4	25.75	26.55	27.41	28.33	No Interference
HSLB 2020-250-6		25				80	6	25.75	26.55	27.41	28.33	30.38
HSLB 2020-300		30				70	4	30.90	31.88	32.91	No Interference	No Interference
HSLB 2020-300-6		30				80	6	30.90	31.88	32.91	34.02	36.50
HSLB 2020-350		35				80	4	36.06	37.20	38.42	No Interference	No Interference
HSLB 2020-350-6		35				80	6	36.06	37.20	38.42	39.72	No Interference
HSLB 2020-400		40				80	4	41.22	42.52	No Interference	No Interference	No Interference
HSLB 2020-400-6		40				90	6	41.22	42.52	43.92	45.41	No Interference
HSLB 2025-060	R1.25	6	2	2.45	16°	45	4	6.20	6.36	6.53	6.72	7.14
HSLB 2025-080		8				45	4	8.26	8.49	8.74	9.00	9.59
HSLB 2025-100		10				45	4	10.32	10.62	10.94	11.28	12.03
HSLB 2025-150		15				50	4	15.48	15.94	16.44	16.97	No Interference
HSLB 2025-200		20				55	4	20.64	21.27	21.94	22.66	No Interference
HSLB 2025-250		25				65	4	25.79	26.59	27.44	No Interference	No Interference
HSLB 2025-300		30				70	4	30.95	31.92	No Interference	No Interference	No Interference
HSLB 2025-350		35				70	4	36.11	37.24	No Interference	No Interference	No Interference
HSLB 2030-060	R1.5	6	2.4	2.95	16°	60	6	6.19	6.34	6.51	6.68	7.08
HSLB 2030-060-3		6				60	3	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2030-060-4		6			16°	60	4	6.19	6.34	6.51	6.68	7.08
HSLB 2030-080		8				60	6	8.25	8.47	8.71	8.96	9.53
HSLB 2030-100		10				60	6	10.31	10.60	10.91	11.24	11.98
HSLB 2030-120		12				60	6	12.38	12.73	13.11	13.52	14.42
HSLB 2030-140		14				60	6	14.44	14.86	15.31	15.79	16.87
HSLB 2030-150		15				60	6	15.47	15.93	16.41	16.93	18.09
HSLB 2030-160		16				60	6	16.50	16.99	17.51	18.07	19.32
HSLB 2030-200		20				70	6	20.63	21.25	21.91	22.63	24.21
HSLB 2030-250		25				70	6	25.78	26.57	27.42	28.32	30.33
HSLB 2030-300		30				70	6	30.94	31.90	32.92	34.01	No Interference
HSLB 2030-350		35				80	6	36.10	37.22	38.42	39.71	No Interference
HSLB 2030-400		40				80	6	41.25	42.55	43.92	No Interference	No Interference

Next Page ➡

Total 309 models

Unit（mm）

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle	Overall Length L	Shank Diameter Ød	Effective Length by Inclined Angles				
								30'	1°	1°30'	2°	3°
HSLB 2035-100	R1.75	10	2.8	3.45	16°	60	6	10.31	10.59	10.88	11.21	11.92
HSLB 2035-150		15				60	6	15.46	15.91	16.39	16.90	18.04
HSLB 2035-200		20				65	6	20.62	21.23	21.89	22.59	24.16
HSLB 2035-250		25				70	6	25.78	26.56	27.39	28.29	No Interference
HSLB 2035-300		30				70	6	30.93	31.88	32.89	33.98	No Interference
HSLB 2035-400		40				90	6	41.25	42.53	43.90	No Interference	No Interference
HSLB 2035-450		45				90	6	46.40	47.85	49.40	No Interference	No Interference
HSLB 2040-080	R2	8	3.2	3.95	16°	70	6	8.23	8.44	8.66	8.89	9.42
HSLB 2040-080-4		8				70	4	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2040-100		10			16°	70	6	10.30	10.57	10.86	11.17	11.87
HSLB 2040-120		12				70	6	12.36	12.70	13.06	13.45	14.31
HSLB 2040-140		14				70	6	14.42	14.83	15.26	15.73	16.76
HSLB 2040-150		15				70	6	15.45	15.89	16.36	16.86	17.99
HSLB 2040-160		16				70	6	16.49	16.96	17.46	18.00	19.21
HSLB 2040-200		20				70	6	20.61	21.22	21.86	22.56	No Interference
HSLB 2040-250		25				70	6	25.77	26.54	27.37	28.25	No Interference
HSLB 2040-300		30				70	6	30.93	31.87	32.87	No Interference	No Interference
HSLB 2040-350		35				80	6	36.08	37.19	38.37	No Interference	No Interference
HSLB 2040-400		40				90	6	41.24	42.51	No Interference	No Interference	No Interference
HSLB 2040-450		45				90	6	46.40	47.84	No Interference	No Interference	No Interference
HSLB 2040-500		50				100	6	51.55	53.16	No Interference	No Interference	No Interference
HSLB 2040-600		60				120	6	61.87	No Interference	No Interference	No Interference	No Interference
HSLB 2050-100	R2.5	10	4	4.95	16°	70	6	10.28	10.54	10.81	11.10	11.76
HSLB 2050-150		15				70	6	15.44	15.86	16.31	16.80	No Interference
HSLB 2050-200		20				70	6	20.60	21.19	21.82	No Interference	No Interference
HSLB 2050-250		25				70	6	25.75	26.51	No Interference	No Interference	No Interference
HSLB 2050-300		30				80	6	30.91	31.83	No Interference	No Interference	No Interference
HSLB 2050-350		35				80	6	36.07	No Interference	No Interference	No Interference	No Interference
HSLB 2050-400		40				90	6	41.22	No Interference	No Interference	No Interference	No Interference
HSLB 2050-450		45				100	6	46.38	No Interference	No Interference	No Interference	No Interference
HSLB 2050-500		50				100	6	51.54	No Interference	No Interference	No Interference	No Interference
HSLB 2060-100	R3	10	4.8	5.95		80	6	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2060-150		15				80	6	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2060-200		20				80	6	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2060-250		25				80	6	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2060-300		30				80	6	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2060-350		35				80	6	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2060-400		40				90	6	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2060-450		45				100	6	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2060-500		50				120	6	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2060-600		60				120	6	No Interference	No Interference	No Interference	No Interference	No Interference

Milling Conditions for HSLB / HSLB-S

WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2001	R0.05	0.2	48,000	55	0.002	0.002	48,000	45	0.002	0.002	48,000	45	0.002	0.002	36,000	22	0.002	0.002
		0.3	48,000	55	0.002	0.002	48,000	45	0.002	0.002	48,000	45	0.002	0.002	36,000	22	0.002	0.002
		0.5	48,000	35	0.002	0.002	48,000	35	0.002	0.002	48,000	35	0.002	0.002	36,000	17	0.002	0.002
20015	R0.075	0.3	48,000	90	0.004	0.004	48,000	70	0.004	0.004	48,000	70	0.004	0.004	36,000	35	0.004	0.004
		0.5	48,000	60	0.004	0.004	48,000	50	0.004	0.004	48,000	50	0.004	0.004	36,000	25	0.004	0.004
		1	48,000	60	0.001	0.002	48,000	20	0.001	0.002	48,000	20	0.001	0.002	36,000	10	0.001	0.002
2002	R0.1	0.3	60,000	200	0.003	0.005	60,000	200	0.002	0.003	60,000	130	0.002	0.003	45,000	65	0.002	0.003
		0.5	60,000	200	0.003	0.005	60,000	200	0.002	0.003	60,000	130	0.002	0.003	45,000	65	0.002	0.003
		0.75	60,000	200	0.003	0.005	60,000	200	0.002	0.003	60,000	130	0.002	0.003	45,000	65	0.002	0.003
		1	60,000	200	0.003	0.005	60,000	200	0.002	0.003	60,000	130	0.002	0.003	45,000	65	0.002	0.003
		1.25	60,000	160	0.002	0.004	54,000	140	0.001	0.002	54,000	95	0.001	0.002	40,500	45	0.001	0.002
		1.5	60,000	130	0.002	0.003	48,000	80	0.001	0.002	48,000	65	0.001	0.002	36,000	30	0.001	0.002
		1.75	60,000	110	0.001	0.002	48,000	60	0.001	0.001	48,000	50	0.001	0.001	36,000	25	0.001	0.001
		2	60,000	90	0.001	0.002	48,000	50	0.001	0.001	48,000	40	0.001	0.001	36,000	20	0.001	0.001
		2.25	53,000	70	0.001	0.001	44,200	40	0.001	0.001	44,200	30	0.001	0.001	33,180	15	0.001	0.001
		2.5	46,850	60	0.001	0.001	40,450	30	0.001	0.001	40,450	20	0.001	0.001	30,350	10	0.001	0.001
		3	33,750	30	0.001	0.001	33,600	20	0.001	0.001	33,600	15	0.001	0.001	25,200	7	0.001	0.001
2003	R0.15	0.5	60,000	350	0.006	0.008	45,000	310	0.004	0.007	43,500	180	0.003	0.005	32,500	90	0.003	0.005
		0.6	60,000	350	0.006	0.008	45,000	310	0.004	0.007	43,500	180	0.003	0.005	32,500	90	0.003	0.005
		0.75	60,000	350	0.006	0.008	45,000	310	0.004	0.007	43,500	180	0.003	0.005	32,500	90	0.003	0.005
		1	60,000	350	0.006	0.008	45,000	310	0.004	0.007	43,500	180	0.003	0.005	32,500	90	0.003	0.005
		1.25	60,000	350	0.006	0.008	45,000	310	0.004	0.007	43,500	180	0.003	0.005	32,500	90	0.003	0.005
		1.5	60,000	350	0.006	0.008	45,000	310	0.004	0.007	43,500	180	0.003	0.005	32,500	90	0.003	0.005
		1.75	60,000	280	0.005	0.007	45,000	250	0.003	0.006	43,500	145	0.002	0.004	32,500	70	0.002	0.004
		2	60,000	210	0.004	0.007	45,000	190	0.003	0.005	43,500	110	0.002	0.004	32,500	55	0.002	0.004
		2.25	55,600	190	0.003	0.006	41,500	160	0.002	0.004	40,000	95	0.001	0.003	30,000	45	0.001	0.003
		2.5	51,250	175	0.003	0.005	38,500	135	0.002	0.004	37,750	85	0.001	0.003	28,300	40	0.001	0.003
		3	42,500	140	0.002	0.004	32,000	80	0.002	0.004	32,000	65	0.001	0.002	24,000	30	0.001	0.002
		4	23,900	45	0.001	0.001	22,550	30	0.001	0.001	22,300	20	0.001	0.001	16,720	10	0.001	0.001
		5	21,000	30	0.001	0.001	20,000	20	0.001	0.001	19,500	10	0.001	0.001	14,600	5	0.001	0.001
2004	R0.2	0.5	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008	26,250	120	0.005	0.008
		0.75	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008	26,250	120	0.005	0.008
		1	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008	26,250	120	0.005	0.008
		1.25	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008	26,250	120	0.005	0.008
		1.5	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008	26,250	120	0.005	0.008
		1.75	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008	26,250	120	0.005	0.008
		2	50,000	500	0.01	0.02	37,500	420	0.007	0.012	35,000	240	0.005	0.008	26,250	120	0.005	0.008
		2.25	47,500	430	0.008	0.016	36,000	360	0.006	0.01	33,750	210	0.004	0.007	25,270	100	0.004	0.007
		2.5	45,000	360	0.007	0.012	34,500	300	0.005	0.008	32,500	190	0.004	0.007	24,300	95	0.004	0.007
		3	40,000	250	0.005	0.008	31,900	210	0.004	0.008	30,500	160	0.003	0.005	22,800	80	0.003	0.005
		3.5	36,000	210	0.004	0.007	28,700	180	0.003	0.006	27,400	140	0.002	0.004	20,550	70	0.002	0.004
		4	32,000	180	0.003	0.005	25,500	150	0.002	0.004	24,300	120	0.002	0.004	18,200	60	0.002	0.004
		4.5	28,500	150	0.002	0.004	23,500	125	0.002	0.003	22,400	100	0.001	0.003	16,800	50	0.001	0.003
		5	25,000	120	0.002	0.003	21,500	100	0.001	0.002	20,500	80	0.001	0.002	15,350	40	0.001	0.002
		6	18,000	60	0.001	0.002	18,000	60	0.001	0.002	17,000	45	0.001	0.002	12,750	20	0.001	0.002

Next Page ➡

Milling Conditions for HSLB / HSLB-S

WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2005	R0.25	1	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01	22,500	150	0.007	0.01
		1.25	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01	22,500	150	0.007	0.01
		1.5	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01	22,500	150	0.007	0.01
		1.75	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01	22,500	150	0.007	0.01
		2	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01	22,500	150	0.007	0.01
		2.25	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01	22,500	150	0.007	0.01
		2.5	44,000	650	0.015	0.04	33,000	530	0.01	0.02	30,000	300	0.007	0.01	22,500	150	0.007	0.01
		3	40,000	500	0.01	0.02	31,000	400	0.007	0.01	28,550	230	0.005	0.008	21,400	115	0.005	0.008
		3.5	36,350	340	0.007	0.017	29,000	270	0.005	0.008	27,100	160	0.003	0.006	20,300	80	0.003	0.006
		4	32,700	180	0.005	0.015	27,150	150	0.003	0.008	25,650	100	0.002	0.005	19,900	50	0.002	0.005
		4.5	29,900	150	0.004	0.01	25,700	130	0.002	0.007	24,500	85	0.002	0.004	18,350	43	0.002	0.004
		5	27,000	135	0.003	0.008	24,200	110	0.002	0.005	23,500	75	0.002	0.004	17,600	35	0.002	0.004
		5.5	24,150	110	0.002	0.006	22,750	90	0.001	0.004	22,400	60	0.001	0.003	16,800	30	0.001	0.003
		6	21,350	90	0.002	0.005	21,300	75	0.001	0.003	21,300	50	0.001	0.002	16,000	25	0.001	0.002
		7	18,600	75	0.001	0.004	18,600	55	0.001	0.002	18,600	35	0.001	0.002	13,950	17	0.001	0.002
		8	15,900	60	0.001	0.003	15,900	40	0.001	0.002	15,900	25	0.001	0.002	11,950	12	0.001	0.002
		9	15,400	55	0.001	0.002	14,750	30	0.001	0.001	14,750	20	0.001	0.001	11,050	10	0.001	0.001
		10	14,900	50	0.001	0.002	13,600	20	0.001	0.001	13,600	15	0.001	0.001	10,200	7	0.001	0.001
2006	R0.3	1	40,000	1,400	0.045	0.15	30,000	1,500	0.03	0.13	26,500	1,000	0.015	0.09	20,000	500	0.015	0.09
		1.25	40,000	1,250	0.035	0.14	30,000	1,350	0.025	0.11	26,500	900	0.01	0.08	20,000	450	0.01	0.08
		1.5	40,000	1,100	0.03	0.13	30,000	1,200	0.02	0.1	26,500	800	0.01	0.075	20,000	400	0.01	0.075
		1.75	40,000	1,100	0.03	0.13	30,000	1,200	0.02	0.1	26,500	800	0.01	0.075	20,000	400	0.01	0.075
		2	40,000	1,100	0.03	0.13	30,000	1,200	0.02	0.1	26,500	800	0.01	0.075	20,000	400	0.01	0.075
		2.25	40,000	950	0.025	0.1	30,000	1,000	0.015	0.09	26,500	660	0.008	0.065	20,000	330	0.008	0.07
		2.5	40,000	800	0.02	0.1	30,000	800	0.015	0.09	26,500	520	0.008	0.065	20,000	260	0.008	0.065
		3	40,000	800	0.02	0.1	30,000	800	0.015	0.09	26,500	520	0.008	0.065	20,000	260	0.008	0.065
		3.5	40,000	500	0.015	0.09	30,000	500	0.01	0.075	26,500	340	0.006	0.05	20,000	170	0.006	0.05
		4	40,000	500	0.015	0.09	30,000	500	0.01	0.075	26,500	340	0.006	0.05	20,000	170	0.006	0.05
		4.5	32,000	400	0.01	0.075	25,000	390	0.007	0.05	23,000	260	0.005	0.04	18,000	130	0.005	0.04
		5	32,000	400	0.01	0.075	25,000	390	0.007	0.05	23,000	260	0.005	0.04	18,000	130	0.005	0.04
		5.5	28,000	350	0.008	0.065	23,000	350	0.006	0.05	21,000	230	0.004	0.04	15,750	115	0.004	0.04
		6	24,000	300	0.007	0.06	21,000	320	0.005	0.04	19,500	210	0.004	0.03	15,000	105	0.004	0.03
		6.5	22,000	270	0.006	0.06	19,500	300	0.004	0.04	18,500	190	0.003	0.03	13,900	95	0.003	0.03
		7	20,000	250	0.006	0.05	18,500	280	0.004	0.03	17,500	180	0.003	0.02	13,100	90	0.003	0.02
		8	16,000	200	0.005	0.05	16,000	240	0.003	0.02	16,000	160	0.003	0.02	12,000	80	0.003	0.02
		9	15,450	185	0.004	0.035	15,450	200	0.002	0.017	15,450	135	0.002	0.017	11,580	65	0.002	0.017
		10	14,900	175	0.003	0.02	14,900	175	0.002	0.015	14,900	115	0.002	0.015	11,100	55	0.002	0.015
		12	13,800	150	0.002	0.015	13,800	110	0.001	0.01	13,800	70	0.001	0.01	10,350	35	0.001	0.01
2007	R0.35	2	37,000	1,350	0.045	0.17	28,500	1,400	0.03	0.135	25,000	900	0.015	0.1	18,750	450	0.015	0.1
		4	31,250	920	0.035	0.15	25,750	975	0.025	0.12	23,750	650	0.012	0.09	17,800	325	0.012	0.09
		6	25,500	500	0.025	0.13	23,000	550	0.02	0.11	22,500	400	0.01	0.08	16,850	200	0.01	0.08
		8	19,000	270	0.007	0.06	17,000	320	0.005	0.04	16,500	220	0.004	0.025	12,350	110	0.004	0.025

Next Page ➡

Milling Conditions for HSLB / HSLB-S

WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2008	R0.4	2	35,000	1,600	0.06	0.21	27,000	1,600	0.04	0.17	23,500	1,000	0.02	0.12	17,500	500	0.02	0.12
		3	35,000	1,400	0.05	0.19	27,000	1,400	0.03	0.15	23,500	900	0.015	0.1	17,500	450	0.015	0.1
		4	35,000	1,200	0.04	0.17	27,000	1,200	0.025	0.135	23,500	600	0.012	0.095	17,500	300	0.012	0.095
		5	31,500	900	0.03	0.15	25,000	900	0.02	0.12	22,000	500	0.01	0.085	16,500	250	0.01	0.085
		6	28,000	600	0.02	0.12	23,000	600	0.012	0.095	20,500	400	0.006	0.065	15,500	200	0.006	0.065
		7	23,750	460	0.016	0.105	20,500	480	0.009	0.08	18,750	340	0.005	0.062	14,000	170	0.005	0.062
		8	19,500	330	0.012	0.095	18,000	375	0.007	0.07	17,000	285	0.005	0.06	12,750	140	0.005	0.06
		9	17,500	290	0.011	0.09	16,000	350	0.006	0.06	15,700	250	0.005	0.05	11,800	125	0.005	0.05
		10	15,000	260	0.01	0.085	14,700	340	0.005	0.06	14,650	225	0.004	0.05	11,000	110	0.004	0.05
		12	14,000	220	0.005	0.06	13,700	290	0.003	0.04	13,650	140	0.002	0.03	10,250	70	0.002	0.03
		16	13,300	185	0.003	0.02	11,100	150	0.001	0.013	11,100	90	0.001	0.013	8,300	45	0.001	0.013
2009	R0.45	2	32,500	1,650	0.1	0.28	25,500	1,800	0.55	0.21	22,000	1,300	0.025	0.14	16,500	650	0.025	0.14
		4	32,500	1,650	0.08	0.25	25,500	1,800	0.04	0.18	22,000	1,300	0.02	0.13	16,500	650	0.02	0.13
		6	29,000	800	0.035	0.17	22,000	800	0.02	0.13	20,000	620	0.015	0.11	15,000	310	0.015	0.11
		8	25,500	700	0.015	0.11	18,500	500	0.01	0.09	18,500	420	0.01	0.09	13,850	210	0.01	0.09
		10	20,000	400	0.012	0.1	15,700	400	0.008	0.08	15,700	300	0.008	0.08	11,800	150	0.008	0.08
		12	15,000	280	0.01	0.09	13,300	300	0.006	0.07	13,300	220	0.006	0.07	10,000	110	0.006	0.07
		14	14,000	240	0.007	0.07	12,000	250	0.004	0.035	12,000	160	0.004	0.035	9,000	80	0.004	0.035
		16	13,700	220	0.005	0.05	10,800	200	0.003	0.03	10,800	130	0.003	0.03	8,100	65	0.003	0.03
		18	13,000	200	0.004	0.025	9,750	150	0.002	0.015	9,750	100	0.002	0.015	7,300	50	0.002	0.015
2010	R0.5	2	30,000	1,750	0.2	0.4	24,000	2,000	0.1	0.3	21,000	1,750	0.05	0.2	16,000	875	0.05	0.2
		2.5	30,000	1,750	0.2	0.4	24,000	2,000	0.1	0.3	21,000	1,750	0.05	0.2	16,000	875	0.05	0.2
		3	30,000	1,750	0.1	0.3	24,000	2,000	0.05	0.2	21,000	1,750	0.03	0.17	16,000	875	0.03	0.17
		4	30,000	1,750	0.1	0.3	24,000	2,000	0.05	0.2	21,000	1,750	0.03	0.17	16,000	875	0.03	0.17
		5	30,000	1,750	0.1	0.3	24,000	2,000	0.05	0.2	21,000	1,750	0.03	0.17	16,000	875	0.03	0.17
		6	30,000	1,150	0.06	0.23	21,500	1,250	0.03	0.17	19,700	1,050	0.025	0.15	14,500	525	0.025	0.15
		7	24,250	800	0.04	0.19	20,000	900	0.02	0.14	19,000	750	0.02	0.14	14,250	375	0.02	0.14
		8	24,000	800	0.025	0.155	18,500	580	0.015	0.12	18,400	480	0.015	0.12	13,800	240	0.015	0.12
		9	23,000	700	0.021	0.14	16,650	500	0.012	0.1	16,550	420	0.012	0.1	12,400	210	0.012	0.1
		10	22,000	600	0.018	0.13	14,800	430	0.01	0.09	14,700	360	0.01	0.09	11,100	180	0.01	0.09
		12	14,150	320	0.015	0.12	13,400	380	0.008	0.08	13,300	290	0.008	0.08	9,950	145	0.008	0.08
		14	13,500	280	0.012	0.1	12,000	350	0.007	0.08	12,000	220	0.007	0.08	9,000	110	0.007	0.08
		16	12,750	240	0.008	0.08	10,500	250	0.005	0.045	10,500	160	0.005	0.045	7,850	80	0.005	0.045
		18	12,350	220	0.006	0.065	9,750	200	0.004	0.035	9,750	130	0.004	0.035	7,300	65	0.004	0.035
		20	12,000	200	0.005	0.03	9,000	150	0.003	0.02	9,000	100	0.003	0.02	6,750	50	0.003	0.02
		22	12,000	150	0.003	0.02	9,000	110	0.002	0.012	9,000	75	0.002	0.012	6,750	35	0.002	0.012

Next Page ➡

Milling Conditions for HSLB / HSLB-S

WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2012	R0.6	2.5	30,000	2,000	0.22	0.46	20,500	2,000	0.11	0.34	17,800	1,750	0.05	0.23	13,350	875	0.05	0.23
		4	30,000	2,000	0.12	0.36	20,000	2,000	0.06	0.24	17,500	1,750	0.036	0.2	13,100	875	0.036	0.2
		6	30,000	2,000	0.12	0.36	20,000	2,000	0.06	0.24	17,500	1,750	0.036	0.2	13,100	875	0.036	0.2
		8	20,200	800	0.05	0.23	16,600	900	0.025	0.17	15,850	750	0.025	0.17	11,900	375	0.025	0.17
		10	15,500	480	0.03	0.18	15,500	580	0.015	0.13	15,350	480	0.015	0.13	11,500	240	0.015	0.13
		12	12,400	360	0.02	0.15	12,400	430	0.01	0.095	12,250	360	0.01	0.095	9,200	180	0.01	0.095
		14	11,850	320	0.018	0.14	11,200	380	0.008	0.085	11,100	290	0.008	0.085	8,300	145	0.008	0.085
		16	11,300	280	0.014	0.12	10,000	360	0.007	0.08	10,000	230	0.007	0.08	7,500	115	0.007	0.08
		18	10,900	260	0.011	0.1	9,400	300	0.006	0.07	9,400	190	0.006	0.07	7,050	95	0.006	0.07
		20	10,500	240	0.009	0.09	8,800	250	0.006	0.05	8,800	160	0.006	0.05	6,600	80	0.006	0.05
2014	R0.7	6	25,200	2,000	0.13	0.42	17,150	2,000	0.065	0.27	15,000	1,750	0.036	0.23	11,250	875	0.036	0.23
		8	25,200	1,300	0.08	0.32	15,350	1,250	0.04	0.23	14,050	1,050	0.03	0.2	10,550	525	0.03	0.2
		12	13,500	450	0.035	0.21	12,500	460	0.025	0.18	12,000	300	0.02	0.16	9,000	150	0.02	0.16
		16	10,000	320	0.016	0.145	9,050	390	0.01	0.12	8,850	230	0.012	0.12	6,650	115	0.012	0.12
2015	R0.75	3	30,000	2,450	0.25	0.55	17,000	2,000	0.12	0.4	15,000	1,750	0.06	0.29	11,250	875	0.06	0.29
		4	30,000	2,450	0.25	0.55	17,000	2,000	0.12	0.4	15,000	1,750	0.06	0.29	11,250	875	0.06	0.29
		6	30,000	2,450	0.15	0.45	17,000	2,000	0.07	0.31	15,000	1,750	0.04	0.24	11,250	875	0.04	0.24
		8	23,500	1,300	0.1	0.37	15,000	1,250	0.045	0.25	14,000	1,050	0.03	0.21	10,500	525	0.03	0.21
		10	23,500	1,300	0.1	0.37	15,000	1,250	0.045	0.25	14,000	1,050	0.03	0.21	10,500	525	0.03	0.21
		12	13,100	480	0.03	0.21	13,000	580	0.02	0.17	13,000	480	0.02	0.17	9,750	240	0.02	0.17
		14	11,200	400	0.025	0.19	10,900	485	0.015	0.145	10,900	385	0.015	0.145	8,200	190	0.015	0.145
		16	9,350	320	0.02	0.17	8,850	390	0.012	0.13	8,800	290	0.012	0.13	6,600	145	0.012	0.13
		18	9,150	300	0.019	0.165	8,400	370	0.011	0.125	8,400	255	0.011	0.125	6,300	125	0.011	0.125
		20	9,000	280	0.018	0.16	8,000	350	0.01	0.12	8,000	220	0.01	0.12	6,000	110	0.01	0.12
		22	8,580	245	0.014	0.13	7,150	320	0.008	0.12	7,150	165	0.008	0.12	5,350	80	0.008	0.12
		25	8,100	210	0.01	0.11	6,250	220	0.006	0.09	6,250	120	0.005	0.08	4,700	60	0.005	0.08
		30	7,600	175	0.006	0.04	5,370	135	0.004	0.03	5,370	75	0.003	0.03	4,000	35	0.003	0.03
2016	R0.8	4	30,000	2,500	0.25	0.58	17,500	2,100	0.12	0.4	15,300	1,800	0.06	0.3	11,500	900	0.06	0.3
		8	30,000	2,500	0.16	0.48	17,500	2,100	0.08	0.32	15,300	1,800	0.05	0.275	11,500	900	0.05	0.275
		12	13,500	500	0.04	0.245	13,500	600	0.024	0.19	13,400	490	0.024	0.19	10,050	245	0.024	0.19
		16	10,800	375	0.03	0.21	10,800	450	0.016	0.15	10,700	370	0.016	0.15	8,000	185	0.016	0.15
		20	10,300	330	0.025	0.19	9,750	400	0.013	0.13	9,650	230	0.013	0.13	8,000	115	0.013	0.13
2018	R0.9	4	30,000	2,700	0.28	0.65	15,000	2,000	0.14	0.48	13,000	1,750	0.07	0.34	9,750	875	0.07	0.34
		6	30,000	2,700	0.18	0.54	15,000	2,000	0.07	0.34	13,000	1,750	0.04	0.26	9,750	875	0.04	0.26
		8	30,000	2,700	0.18	0.54	15,000	2,000	0.07	0.34	13,000	1,750	0.04	0.26	9,750	875	0.04	0.26
		10	25,750	2,000	0.14	0.48	14,400	1,650	0.06	0.32	12,900	1,425	0.035	0.24	9,700	713	0.035	0.24
		12	21,500	1,350	0.1	0.41	13,800	1,350	0.05	0.29	12,800	1,100	0.03	0.23	9,600	550	0.03	0.23
		16	15,550	860	0.065	0.33	11,700	900	0.03	0.22	11,150	730	0.02	0.18	8,400	365	0.02	0.18
		18	9,600	375	0.03	0.23	9,600	450	0.015	0.16	9,500	370	0.01	0.13	7,150	185	0.01	0.13
		20	9,300	350	0.027	0.21	9,050	420	0.014	0.15	9,000	330	0.009	0.12	6,750	165	0.009	0.12
		22	9,000	320	0.025	0.2	8,500	400	0.012	0.14	8,500	290	0.008	0.15	6,400	145	0.008	0.15
		25	8,500	280	0.02	0.18	7,750	320	0.01	0.1	7,750	220	0.007	0.09	5,800	110	0.007	0.09
		30	8,000	240	0.015	0.15	7,000	250	0.009	0.07	7,000	160	0.006	0.06	5,250	80	0.006	0.06

Next Page ➡

Milling Conditions for HSLB / HSLB-S

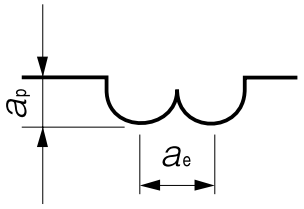
WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2020	R1	3	28,000	2,900	0.3	0.7	14,000	2,100	0.15	0.5	12,250	1,800	0.08	0.35	9,200	900	0.08	0.35
		4	28,000	2,900	0.3	0.7	14,000	2,100	0.15	0.5	12,250	1,800	0.08	0.35	9,200	900	0.08	0.35
		6	28,000	2,900	0.2	0.6	14,000	2,100	0.1	0.4	12,250	1,800	0.06	0.3	9,200	900	0.06	0.3
		8	28,000	2,900	0.2	0.6	14,000	2,100	0.1	0.4	12,250	1,800	0.06	0.3	9,200	900	0.06	0.3
		10	28,000	2,900	0.2	0.6	14,000	2,100	0.1	0.4	12,250	1,800	0.06	0.3	9,200	900	0.06	0.3
		12	19,500	1,350	0.12	0.45	12,400	1,350	0.06	0.34	11,500	1,100	0.045	0.27	8,650	550	0.045	0.27
		13	19,500	1,350	0.12	0.45	12,400	1,350	0.06	0.34	11,500	1,100	0.045	0.27	8,650	550	0.045	0.27
		14	19,500	1,350	0.12	0.45	12,400	1,350	0.06	0.34	11,500	1,100	0.045	0.27	8,650	550	0.045	0.27
		16	10,800	500	0.05	0.3	10,800	600	0.03	0.24	10,700	490	0.03	0.24	8,000	245	0.03	0.24
		18	9,700	435	0.04	0.28	9,700	520	0.025	0.22	9,650	430	0.025	0.22	7,250	215	0.025	0.22
		20	8,650	375	0.035	0.25	8,650	450	0.02	0.19	8,560	370	0.02	0.19	6,400	185	0.02	0.19
		22	8,450	350	0.032	0.245	8,200	440	0.018	0.18	8,200	330	0.018	0.18	6,150	165	0.018	0.18
		25	8,250	320	0.03	0.24	7,800	440	0.016	0.16	7,800	290	0.016	0.16	5,850	145	0.016	0.16
		30	7,850	280	0.024	0.2	7,000	350	0.014	0.16	7,000	220	0.014	0.16	5,250	110	0.014	0.16
		35	7,450	240	0.016	0.16	6,150	250	0.01	0.09	6,150	160	0.01	0.09	4,600	80	0.01	0.09
		40	7,000	200	0.01	0.06	5,250	150	0.006	0.04	5,250	100	0.006	0.04	3,950	50	0.006	0.04
2025	R1.25	6	25,000	3,000	0.35	0.85	12,400	2,200	0.17	0.6	11,000	1,850	0.1	0.45	8,250	920	0.1	0.45
		8	25,000	3,000	0.24	0.76	12,400	2,200	0.13	0.51	11,000	1,850	0.08	0.38	8,250	920	0.08	0.38
		10	25,000	3,000	0.24	0.76	12,400	2,200	0.13	0.51	11,000	1,850	0.08	0.38	8,250	920	0.08	0.38
		15	17,300	1,400	0.145	0.57	11,000	1,400	0.08	0.44	10,300	1,140	0.06	0.35	7,700	570	0.06	0.35
		20	9,600	520	0.06	0.38	9,600	630	0.04	0.31	9,600	510	0.04	0.31	7,200	255	0.04	0.31
		25	6,900	375	0.042	0.32	6,900	450	0.024	0.235	6,840	370	0.024	0.235	5,150	185	0.024	0.235
		30	6,500	320	0.025	0.24	6,200	400	0.02	0.22	6,200	280	0.02	0.22	4,650	140	0.02	0.22
		35	6,200	280	0.017	0.2	5,500	350	0.014	0.18	5,500	220	0.014	0.18	4,150	110	0.014	0.18
2030	R1.5	6	21,000	3,000	0.4	1	10,500	2,200	0.2	0.7	9,200	1,900	0.12	0.55	6,900	950	0.12	0.55
		8	21,000	3,000	0.4	1	10,500	2,200	0.2	0.7	9,200	1,900	0.12	0.55	6,900	950	0.12	0.55
		10	21,000	3,000	0.3	0.9	10,500	2,200	0.15	0.65	9,200	1,900	0.1	0.5	6,900	950	0.1	0.5
		12	21,000	3,000	0.3	0.9	10,500	2,200	0.15	0.65	9,200	1,900	0.1	0.5	6,900	950	0.1	0.5
		14	21,000	3,000	0.3	0.9	10,500	2,200	0.15	0.65	9,200	1,900	0.1	0.5	6,900	950	0.1	0.5
		15	21,000	3,000	0.3	0.9	10,500	2,200	0.15	0.65	9,200	1,900	0.1	0.5	6,900	950	0.1	0.5
		16	21,000	3,000	0.3	0.9	10,500	2,200	0.15	0.65	9,200	1,900	0.1	0.5	6,900	950	0.1	0.5
		20	14,500	1,360	0.18	0.7	9,250	1,400	0.1	0.5	8,600	1,150	0.075	0.45	6,450	575	0.075	0.45
		25	8,000	520	0.07	0.45	8,000	630	0.05	0.38	8,000	510	0.05	0.38	6,000	255	0.05	0.38
		30	5,750	375	0.05	0.38	5,750	450	0.03	0.29	5,700	370	0.03	0.29	4,275	185	0.03	0.29
		35	5,550	335	0.045	0.36	5,350	440	0.025	0.27	5,350	310	0.025	0.27	4,000	155	0.025	0.27
		40	5,350	300	0.04	0.34	4,900	390	0.02	0.24	4,850	250	0.02	0.24	3,650	125	0.02	0.24
2035	R1.75	10	19,000	3,000	0.35	1.05	10,000	2,200	0.17	0.75	8,400	1,900	0.11	0.61	6,300	950	0.11	0.61
		15	19,000	3,000	0.35	1.05	10,000	2,200	0.17	0.75	8,400	1,900	0.11	0.61	6,300	950	0.11	0.61
		20	19,000	3,000	0.35	1.05	10,000	2,200	0.17	0.75	8,400	1,900	0.11	0.61	6,300	950	0.11	0.61
		25	13,000	1,750	0.21	0.83	8,450	1,400	0.11	0.61	7,650	1,200	0.08	0.52	5,750	600	0.08	0.52
		30	6,900	520	0.08	0.52	6,900	630	0.06	0.45	6,900	510	0.06	0.45	5,200	255	0.06	0.45
		40	5,750	410	0.06	0.45	5,550	510	0.04	0.37	5,500	380	0.04	0.37	4,150	190	0.04	0.37
		45	4,600	300	0.045	0.39	4,200	390	0.025	0.29	4,100	250	0.025	0.29	3,100	125	0.025	0.29

Next Page ➡

Milling Conditions for HSLB / HSLB-S

WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Radius of Ball Nose (mm)	Effective Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
2040	R2	8	18,000	3,200	0.5	1.3	9,000	2,300	0.25	0.95	7,900	2,000	0.15	0.75	5,900	1,000	0.15	0.75
		10	18,000	3,200	0.5	1.3	9,000	2,300	0.25	0.95	7,900	2,000	0.15	0.75	5,900	1,000	0.15	0.75
		12	18,000	3,200	0.4	1.2	9,000	2,300	0.2	0.85	7,900	2,000	0.13	0.7	5,900	1,000	0.13	0.7
		14	18,000	3,200	0.4	1.2	9,000	2,300	0.2	0.85	7,900	2,000	0.13	0.7	5,900	1,000	0.13	0.7
		15	18,000	3,200	0.4	1.2	9,000	2,300	0.2	0.85	7,900	2,000	0.13	0.7	5,900	1,000	0.13	0.7
		16	18,000	3,200	0.4	1.2	9,000	2,300	0.2	0.85	7,900	2,000	0.13	0.7	5,900	1,000	0.13	0.7
		20	18,000	3,200	0.4	1.2	9,000	2,300	0.2	0.85	7,900	2,000	0.13	0.7	5,900	1,000	0.13	0.7
		25	12,500	1,500	0.25	0.95	8,000	1,450	0.13	0.7	7,450	1,250	0.09	0.55	5,600	625	0.09	0.55
		30	7,000	550	0.1	0.6	7,000	660	0.06	0.45	7,000	540	0.06	0.45	5,250	270	0.06	0.45
		35	6,000	520	0.09	0.59	6,000	630	0.055	0.43	6,000	510	0.055	0.43	4,500	255	0.055	0.43
		40	4,300	375	0.065	0.5	4,300	450	0.04	0.39	4,300	370	0.04	0.39	3,200	185	0.04	0.39
		45	4,150	330	0.058	0.47	4,000	440	0.033	0.36	4,000	300	0.033	0.36	3,000	150	0.033	0.36
		50	4,000	300	0.053	0.44	3,750	400	0.03	0.33	3,750	260	0.03	0.33	2,800	130	0.03	0.33
		60	3,900	280	0.048	0.4	3,500	350	0.028	0.3	3,500	220	0.028	0.3	2,600	110	0.028	0.3
2050	R2.5	10	14,400	3,200	0.5	1.5	7,200	2,300	0.25	1.05	6,350	2,000	0.16	0.88	4,750	1,000	0.16	0.88
		15	14,400	3,200	0.5	1.5	7,200	2,300	0.25	1.05	6,350	2,000	0.16	0.88	4,750	1,000	0.16	0.88
		20	14,400	3,200	0.5	1.5	7,200	2,300	0.25	1.05	6,350	2,000	0.16	0.88	4,750	1,000	0.16	0.88
		25	12,200	2,350	0.405	1.35	6,800	1,850	0.205	0.95	6,250	1,600	0.135	0.805	4,650	800	0.135	0.805
		30	10,000	1,500	0.31	1.2	6,400	1,450	0.16	0.88	6,200	1,250	0.11	0.73	4,650	625	0.11	0.73
		35	8,000	1,050	0.21	1	6,200	1,070	0.12	0.76	6,100	900	0.095	0.68	4,600	450	0.095	0.68
		40	6,000	570	0.125	0.78	6,000	690	0.08	0.625	6,000	570	0.08	0.625	4,500	285	0.08	0.625
		45	5,150	500	0.11	0.72	5,150	600	0.07	0.4	5,100	500	0.07	0.4	3,800	250	0.07	0.4
		50	4,300	430	0.09	0.65	4,300	510	0.06	0.18	4,200	435	0.06	0.18	3,150	215	0.06	0.18
2060	R3	10	13,000	3,500	0.6	1.8	6,500	2,500	0.3	1.3	5,700	2,200	0.2	1	4,300	1,100	0.2	1
		15	13,000	3,500	0.6	1.8	6,500	2,500	0.3	1.3	5,700	2,200	0.2	1	4,300	1,100	0.2	1
		20	13,000	3,500	0.6	1.8	6,500	2,500	0.3	1.3	5,700	2,200	0.2	1	4,300	1,100	0.2	1
		25	13,000	3,500	0.6	1.8	6,500	2,500	0.3	1.3	5,700	2,200	0.2	1	4,300	1,100	0.2	1
		30	13,000	3,500	0.6	1.8	6,500	2,500	0.3	1.3	5,700	2,200	0.2	1	4,300	1,100	0.2	1
		35	11,000	2,750	0.48	1.6	6,100	2,050	0.25	1.05	5,500	1,800	0.175	0.8	4,150	900	0.175	0.8
		40	9,000	2,050	0.375	1.35	5,750	1,600	0.2	0.8	5,350	1,400	0.15	0.65	4,000	700	0.15	0.65
		45	7,000	1,300	0.26	1.1	5,350	1,150	0.15	0.55	5,150	1,000	0.125	0.45	3,850	500	0.125	0.45
		50	5,000	600	0.15	0.9	5,000	720	0.1	0.3	5,000	600	0.1	0.3	3,750	300	0.1	0.3
		60	3,600	430	0.105	0.75	3,600	510	0.08	0.22	3,550	435	0.08	0.22	2,650	215	0.08	0.22

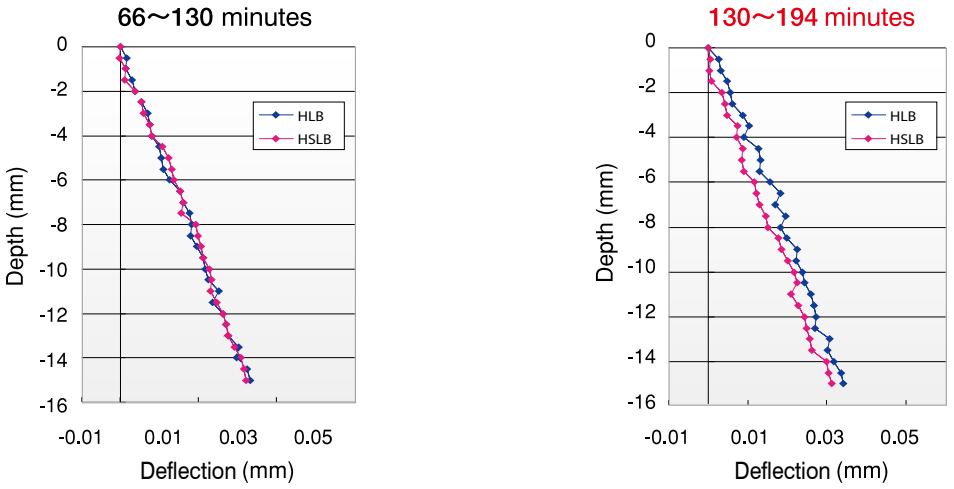
a_p : Axial Depth (mm)
a_e : Radial Depth (mm)

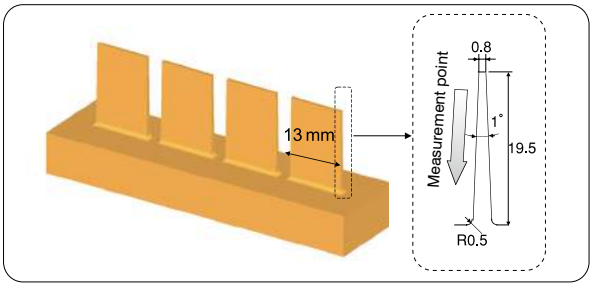


Note:
- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when burr and red-hot occur.
- Every coolant offers stable milling.

Copper Electrode Milling Comparison : HSLB generates less side force to reduce work piece deflection

Variable rake cutting edge reduces tool deflection!
Better wear resistance than conventional +Rake
After extended milling time,new HSLB makes less deflection than conventional HLB!

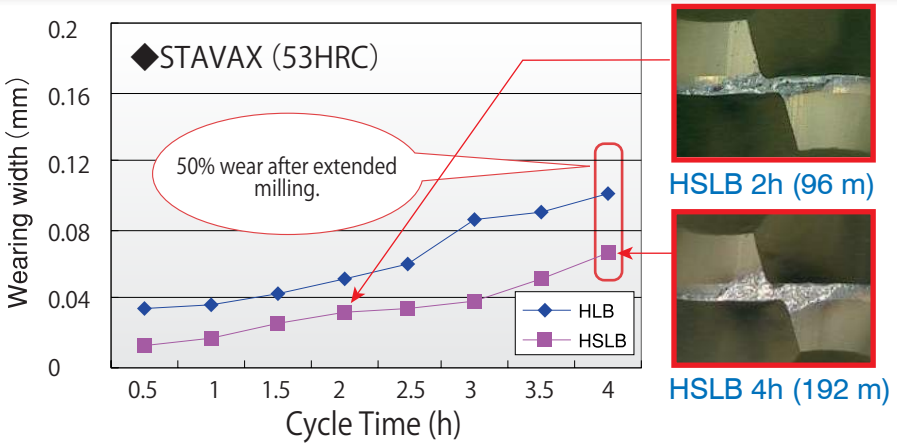




Size: R0.5 x Effective Length 20 mm

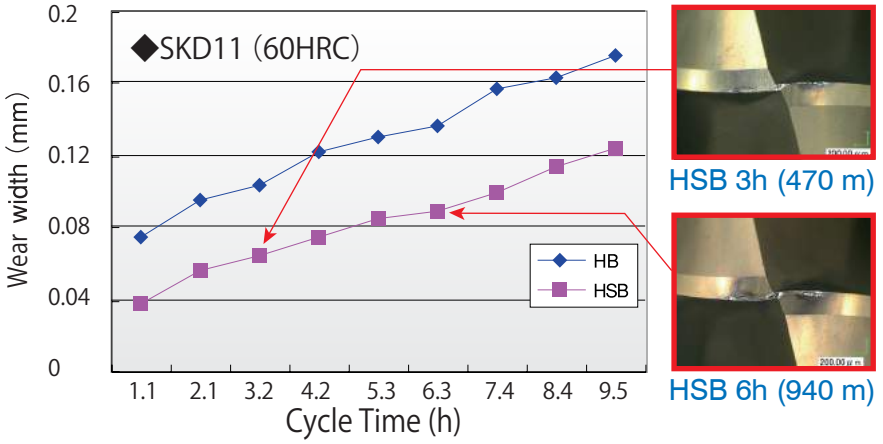
Work Material	Copper （C1100 ）
Spindle Speed n	9,350 min $^{-1}$
Feed Rate V_f	540 mm/min
Velocity V_c	29.4 m/min
Feed per tooth f_z	0.029 mm/tooth
Axial Depth a_p	0.017 mm
Radial Depth a_e	0.01 mm
Overhang Length	30 mm
Cycle Time	66 min/pocket
Coolant	Water Soluble
Milling Metho d	Contourin g

Wear Comparison: HSB applies a wide range of materials with excellent performance.



Size: R0.5 x Effective Length 6 mm

Work Material	STAVAX (53HRC)
Spindle Speed n	24,000 min^{-1}
Feed Rate Vf	800 mm/min
Velocity Vc	75.4 m/min
Feed per tooth f_z	0.017 mm/tooth
Axial Depth a_p	0.024 mm
Radial Depth a_e	0.057 mm
Overhang Length	20 mm
Coolant	Air Blow
Milling Method	Flat Pocket Milling



Size: R3 x Length of Cut 9 mm

Work Material	SKD11 (60HRC)
Spindle Speed n	10,000 min^{-1}
Feed Rate Vf	3,000 mm/min
Velocity Vc	188 m/min
Feed per tooth f_z	0.15 mm/tooth
Axial Depth a_p	0.1 mm
Radial Depth a_e	0.15 mm
Overhang Length	20 mm
Coolant	Air Blow
Milling Method	Surface Finish (both way)

Size **R0.1～R3**

NEW

Short Shank Series

HSLB-S

Super MG | HARD MAX | 30° | R ±0.003 R0.1～R2 | R ±0.005 R3 | Shank Dia 0/-0.004 | Back Taper Geometry ～Except for R0.4 ℓ1/D 10

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ～55HRC	Hardened Steels ～60HRC	Hardened Steels ～70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
○	○	◎	◎	◎	◎	○			○			○	○		

Features

Short Shank Ball End Mills for high accuracy shrink-fit holder
Offers high efficiency, long tool life and excellent surface finish on hard materials over 40HRC.
New and harder HARDMAX coat is adopted maintaining heat resistance, durability and lubricity at a high level.
Every coolant offers stable milling.
Ball tip point is designed with a negative rake angle that minimizes wear and improves the target dimensions.
The low negative rake angle at the peripheral side of the ball offers an excellent surface finish and prevents deflection.

Tighter Tolerance Design! Diameter Tolerance, Ball Radius Accuracy, and Shank Diameter Tolerance

HSB / HSLB Tolerance

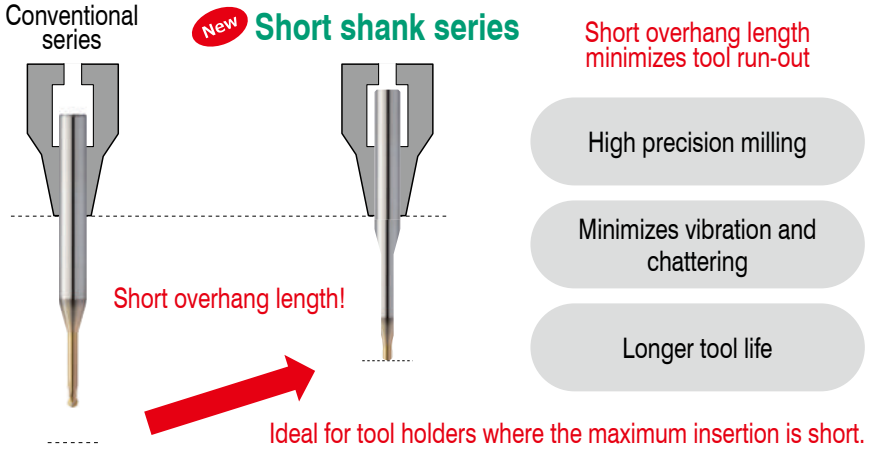
Radius of Ball Nose	Diameter Tolerance	Ball Radius Accuracy	Shank Diameter Tolerance
R0.1 ～ R3	0/-0.015	± 0.005	0/-0.005 (h5)

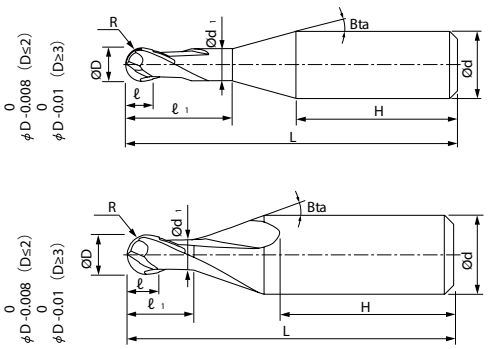
HSB-S / HSLB-S Tolerance

Radius of Ball Nose	Diameter Tolerance	Ball Radius Accuracy	Shank Diameter Tolerance
R0.1 ～ R1	0/-0.008	± 0.003	0/-0.004 (h4)
R1.5 ～ R2	0/-0.01		
R3		± 0.005	

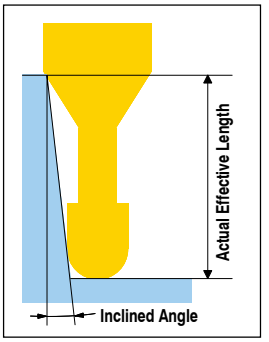
Shank diameter tolerance h4!

Short overhang length with short shank length!





The shank taper angle and the shank length (H) shown are not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.



Unit (mm)

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Shank Length H	Effective Length by Inclined Angles				
									30′	1°	1°30′	2°	3°
HSLB 2002-005S	R0.1	0.5	0.16	0.19	16°	35	4	26.0	0.63	0.66	0.68	0.71	0.76
HSLB 2002-010S		1				35	4	25.5	1.15	1.20	1.24	1.28	1.37
HSLB 2003-005S	R0.15	0.5	0.24	0.29	16°	35	4	26.0	0.63	0.65	0.68	0.70	0.75
HSLB 2003-0075S		0.75				35	4	26.0	0.89	0.92	0.96	0.99	1.05
HSLB 2003-010S		1				35	4	25.5	1.15	1.19	1.23	1.27	1.36
HSLB 2003-015S		1.5				35	4	25.0	1.66	1.72	1.77	1.83	1.96
HSLB 2004-005S	R0.2	0.5	0.32	0.39	16°	35	4	26.5	0.63	0.65	0.67	0.70	0.74
HSLB 2004-010S		1				35	4	26.0	1.15	1.19	1.23	1.26	1.35
HSLB 2004-015S		1.5				35	4	25.5	1.66	1.71	1.77	1.82	1.95
HSLB 2004-020S		2				35	4	25.0	2.18	2.25	2.32	2.39	2.56
HSLB 2004-025S		2.5				35	4	24.5	2.70	2.78	2.87	2.96	3.17
HSLB 2004-030S		3				35	4	24.0	3.21	3.31	3.42	3.53	3.79
HSLB 2005-010S	R0.25	1	0.4	0.49	16°	35	4	26.0	1.15	1.19	1.22	1.26	1.34
HSLB 2005-015S		1.5				35	4	25.5	1.65	1.71	1.76	1.82	1.94
HSLB 2005-020S		2				35	4	25.0	2.18	2.24	2.31	2.39	2.55
HSLB 2005-025S		2.5				35	4	24.5	2.69	2.78	2.86	2.96	3.16
HSLB 2005-030S		3				35	4	24.0	3.21	3.31	3.41	3.53	3.77
HSLB 2006-010S	R0.3	1	0.48	0.59	16°	35	4	26.0	1.14	1.18	1.22	1.25	1.33
HSLB 2006-015S		1.5				35	4	25.5	1.65	1.71	1.76	1.81	1.93
HSLB 2006-020S		2				35	4	25.0	2.17	2.24	2.31	2.38	2.54
HSLB 2006-030S		3				35	4	24.0	3.21	3.31	3.41	3.52	3.76
HSLB 2006-040S		4				40	4	28.0	4.24	4.37	4.51	4.66	4.99
HSLB 2006-050S		5				40	4	27.0	5.27	5.44	5.61	5.80	6.21
HSLB 2006-060S		6				40	4	26.0	6.30	6.50	6.71	6.93	7.43
HSLB 2008-020S	R0.4	2	0.64	0.79	16°	35	4	25.5	2.17	2.23	2.30	2.37	2.52
HSLB 2008-030S		3				35	4	24.5	3.21	3.30	3.40	3.50	3.74
HSLB 2008-040S		4				35	4	23.5	4.24	4.36	4.50	4.64	4.97
HSLB 2008-060S		6				40	4	26.5	6.30	6.49	6.70	6.92	7.41

Next Page ➡

2 Flutes HARDMAX

Total 61 models

Unit (mm)

Model Number	Radius of Ball Nose R	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Shank Length H	Effective Length by Inclined Angles				
									30′	1°	1°30′	2°	3°
HSLB 2010-020S	R0.5	2	0.8	0.98	16°	35	4	25.5	2.18	2.24	2.30	2.36	2.51
HSLB 2010-025S		2.5				35	4	25.0	2.70	2.77	2.85	2.93	3.12
HSLB 2010-030S		3				35	4	24.5	3.21	3.30	3.40	3.50	3.73
HSLB 2010-040S		4				35	4	23.5	4.24	4.37	4.50	4.64	4.96
HSLB 2010-060S		6				40	4	26.5	6.31	6.50	6.70	6.92	7.40
HSLB 2010-080S		8				40	4	24.5	8.37	8.63	8.90	9.20	9.85
HSLB 2015-030S	R0.75	3	1.2	1.47	16°	35	4	25.5	3.10	3.18	3.26	3.35	3.55
HSLB 2015-040S		4				35	4	24.5	4.13	4.24	4.36	4.49	4.77
HSLB 2015-060S		6				40	4	27.5	6.19	6.37	6.56	6.76	7.22
HSLB 2015-080S		8				40	4	25.5	8.25	8.50	8.76	9.04	9.67
HSLB 2015-100S		10				40	4	23.5	10.32	10.63	10.96	11.32	12.11
HSLB 2020-030S	R1	3	1.6	1.98	16°	35	4	26.5	3.07	3.14	3.21	3.29	3.47
HSLB 2020-040S		4				35	4	25.5	4.10	4.20	4.31	4.43	4.70
HSLB 2020-060S		6				35	4	23.5	6.16	6.33	6.51	6.71	7.14
HSLB 2020-080S		8				40	4	26.5	8.23	8.46	8.72	8.99	9.59
HSLB 2020-100S		10				40	4	24.5	10.29	10.59	10.92	11.26	12.04
HSLB 2020-120S		12				45	4	27.5	12.35	12.72	13.12	13.54	14.48
HSLB 2020-140S		14				45	4	25.5	14.41	14.85	15.32	15.82	16.93
HSLB 2020-160S		16				50	4	28.5	16.48	16.98	17.52	18.10	19.38
HSLB 2020-200S		20				50	4	24.5	20.60	21.24	21.92	22.65	No Interference
HSLB 2030-060-4S	R1.5	6	2.4	2.95	16°	35	4	25.0	6.20	6.35	6.52	6.69	7.09
HSLB 2030-080-4S		8				40	4	28.0	8.26	8.48	8.72	8.97	9.54
HSLB 2030-100-4S		10				40	4	26.0	10.32	10.61	10.92	11.25	No Interference
HSLB 2030-120-4S		12				40	4	24.0	12.38	12.74	13.12	13.53	No Interference
HSLB 2030-160-4S		16				45	4	25.0	16.51	17.00	17.52	No Interference	No Interference
HSLB 2030-200-4S		20				50	4	26.0	20.64	21.26	No Interference	No Interference	No Interference
HSLB 2040-080-4S	R2	8	3.2	3.95	-	35	4	24.0	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2040-100-4S		10				40	4	28.0	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2040-120-4S		12				40	4	26.0	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2040-160-4S		16				45	4	27.0	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2040-200-4S		20				50	4	28.0	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2060-150S	R3	15	4.8	5.95	-	45	6	28.0	No Interference	No Interference	No Interference	No Interference	No Interference
HSLB 2060-200S		20				50	6	28.0	No Interference	No Interference	No Interference	No Interference	No Interference

Size **R0.1~R3**

HTNB

Super MG | HARD MAX | 30° | R ±0.005 | Shank Dia 0/-0.005 | Back Taper Geometry

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

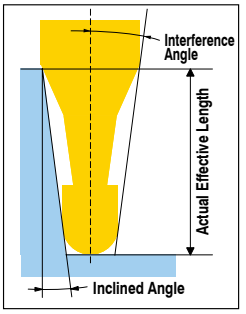
Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
○	○	◎	◎	◎	◎ ~65HRC	○			◎			○	○		

Total 197 models

Model Number	Radius of Ball Nose R	Neck Taper Angle TN	Neck Length ℓ2	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Shape
HTNB 2002-015-1	R0.1	30′	1.5	-	0.16	-	16°	50	4	A
HTNB 2002-020-1			2					50	4	
HTNB 2002-030-1			3					50	4	
HTNB 2002-015-2		1°	1.5					50	4	
HTNB 2002-020-2			2					50	4	
HTNB 2002-030-2			3					50	4	
HTNB 2002-015-3		1°30′	1.5					50	4	
HTNB 2002-020-3			2					50	4	
HTNB 2002-030-3			3					50	4	
HTNB 2003-020-1	R0.15	30′	2	-	0.24	-	16°	50	4	A
HTNB 2003-030-1			3					50	4	
HTNB 2003-020-2		1°	2					50	4	
HTNB 2003-030-2			3					50	4	
HTNB 2003-020-3		1°30′	2					50	4	
HTNB 2003-030-3			3					50	4	
HTNB 2004-030-1	R0.2	30′	3	-	0.32	-	16°	50	4	A
HTNB 2004-040-1			4					50	4	
HTNB 2004-060-1			6					50	4	
HTNB 2004-030-2		1°	3					50	4	
HTNB 2004-040-2			4					50	4	
HTNB 2004-060-2			6					50	4	
HTNB 2004-030-3		1°30′	3					50	4	
HTNB 2004-040-3			4					50	4	
HTNB 2004-060-3			6					50	4	

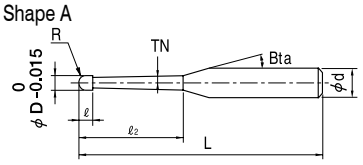
Features

Higher rigidity with the taper neck shape.
Stable milling and excellent surface on deep milling.
Coated with new HARDMAX.
Improved hardness and well balanced with heat-resistance, durability and lubricity on hard milling up to 65HRC.
High Radius Accuracy: ± 0.005, Diameter Tolerance:0/-0.015

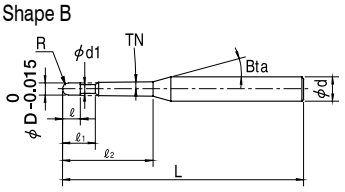


The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

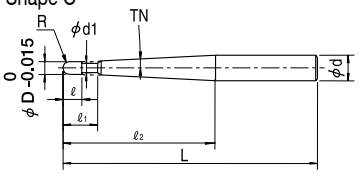
Shape A



Shape B



Shape C



Unit（mm）

Model Number	Radius of Ball Nose R	Interference Angle	Effective Length by Inclined Angles - : Interference				
			30′	1°	1°30′	2°	3°
HTNB 2002-015-1	R0.1	13.36	-	1.50	1.55	1.60	1.72
HTNB 2002-020-1		12.63	-	2.01	2.08	2.15	2.31
HTNB 2002-030-1		11.37	-	3.05	3.15	3.26	3.50
HTNB 2002-015-2		13.41	-	-	1.51	1.56	1.68
HTNB 2002-020-2		12.69	-	-	2.03	2.10	2.25
HTNB 2002-030-2		11.46	-	-	3.06	3.17	3.40
HTNB 2002-015-3		13.46	-	-	-	1.53	1.64
HTNB 2002-020-3		12.76	-	-	-	2.04	2.19
HTNB 2002-030-3		11.56	-	-	-	3.08	3.31
HTNB 2003-020-1	R0.15	12.62	-	2.01	2.08	2.15	2.30
HTNB 2003-030-1		11.34	-	3.05	3.15	3.25	3.49
HTNB 2003-020-2		12.68	-	-	2.03	2.10	2.25
HTNB 2003-030-2		11.43	-	-	3.06	3.17	3.40
HTNB 2003-020-3		12.75	-	-	-	2.05	2.19
HTNB 2003-030-3		11.52	-	-	-	3.08	3.31
HTNB 2004-030-1	R0.2	11.30	-	3.04	3.14	3.25	3.48
HTNB 2004-040-1		10.23	-	4.08	4.21	4.35	4.67
HTNB 2004-060-1		8.60	-	6.14	6.34	6.56	7.04
HTNB 2004-030-2		11.38	-	-	3.06	3.17	3.39
HTNB 2004-040-2		10.33	-	-	4.10	4.23	4.54
HTNB 2004-060-2		8.72	-	-	6.16	6.37	6.84
HTNB 2004-030-3		11.48	-	-	-	3.08	3.30
HTNB 2004-040-3		10.44	-	-	-	4.12	4.42
HTNB 2004-060-3		8.84	-	-	-	6.19	6.64

Next Page ➡

2 Flutes HARDMAX

	Model Number	Radius of Ball Nose R	Neck Taper Angle TN	Neck Length ℓ2	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Shape
	HTNB 2005-040-1	R0.25	30′	4	-	0.4	-	16°	50	4	A
	HTNB 2005-060-1			6					50	4	
	HTNB 2005-080-1			8					50	4	
	HTNB 2005-100-1			10					50	4	
	HTNB 2005-040-2		1°	4					50	4	
	HTNB 2005-060-2			6					50	4	
	HTNB 2005-080-2			8					50	4	
	HTNB 2005-100-2			10					50	4	
	HTNB 2005-040-3		1°30′	4					50	4	
	HTNB 2005-060-3			6					50	4	
	HTNB 2005-080-3			8					50	4	
	HTNB 2005-100-3			10					50	4	
	HTNB 2006-040-1	R0.3	30′	4	0.9	0.48	0.56	16°	50	4	B
	HTNB 2006-060-1			6					50	4	
	HTNB 2006-080-1			8					50	4	
	HTNB 2006-100-1			10					50	4	
	HTNB 2006-120-1			12					50	4	
	HTNB 2006-160-1			16					50	4	
※	HTNB 2006-200-1			20					50	4	
	HTNB 2006-040-2		1°	4					50	4	
	HTNB 2006-060-2			6					50	4	
	HTNB 2006-080-2			8					50	4	
	HTNB 2006-100-2			10					50	4	
	HTNB 2006-120-2			12					50	4	
※	HTNB 2006-140-2			14					50	4	
	HTNB 2006-160-2			16					50	4	
※	HTNB 2006-200-2			20					50	4	
	HTNB 2006-040-3		1°30′	4					50	4	
	HTNB 2006-060-3			6					50	4	
	HTNB 2006-080-3			8					50	4	
	HTNB 2006-100-3			10					50	4	
	HTNB 2006-120-3			12					50	4	
	HTNB 2006-160-3			16					50	4	
※	HTNB 2008-060-1	R0.4	30′	6	1.2	0.64	0.76	16°	50	4	B
	HTNB 2008-080-1			8					50	4	
	HTNB 2008-120-1			12					60	4	
※	HTNB 2008-160-1			16					60	4	
※	HTNB 2008-060-2		1°	6					50	4	
	HTNB 2008-080-2			8					50	4	
	HTNB 2008-120-2			12					60	4	
※	HTNB 2008-160-2			16					60	4	
※	HTNB 2008-060-3		1°30′	6	1.2	0.64	0.76	16°	50	4	
	HTNB 2008-080-3			8					50	4	
	HTNB 2008-120-3			12					60	4	
※	HTNB 2008-160-3			16					60	4	

Unit（mm）

	Model Number	Radius of Ball Nose R	Interference Angle	Effective Length by Inclined Angles - : Interference				
				30′	1°	1°30′	2°	3°
	HTNB 2005-040-1	R0.25	10.17	-	4.08	4.21	4.35	4.66
	HTNB 2005-060-1		8.52	-	6.14	6.34	6.55	7.03
	HTNB 2005-080-1		7.33	-	8.21	8.48	8.76	9.41
	HTNB 2005-100-1		6.43	-	10.27	10.61	10.97	11.78
	HTNB 2005-040-2		10.27	-	-	4.10	4.23	4.54
	HTNB 2005-060-2		8.64	-	-	6.16	6.37	6.84
	HTNB 2005-080-2		7.45	-	-	8.23	8.51	9.13
	HTNB 2005-100-2		6.55	-	-	10.30	10.65	11.43
	HTNB 2005-040-3		10.38	-	-	-	4.12	4.41
	HTNB 2005-060-3		8.76	-	-	-	6.19	6.64
	HTNB 2005-080-3		7.57	-	-	-	8.26	8.86
	HTNB 2005-100-3		6.67	-	-	-	10.33	11.09
	HTNB 2006-040-1	R0.3	10.10	-	4.08	4.21	4.34	4.65
	HTNB 2006-060-1		8.44	-	6.14	6.34	6.55	7.03
	HTNB 2006-080-1		7.24	-	8.21	8.47	8.76	9.40
	HTNB 2006-100-1		6.33	-	10.27	10.61	10.97	11.77
	HTNB 2006-120-1		5.63	-	12.34	12.74	13.18	14.14
	HTNB 2006-160-1		4.61	-	16.46	17.01	17.59	18.89
※	HTNB 2006-200-1		3.90	-	20.60	21.28	22.01	23.64
	HTNB 2006-040-2		10.21	-	-	4.10	4.23	4.53
	HTNB 2006-060-2		8.55	-	-	6.17	6.37	6.83
	HTNB 2006-080-2		7.36	-	-	8.23	8.51	9.13
	HTNB 2006-100-2		6.45	-	-	10.30	10.65	11.43
	HTNB 2006-120-2		5.74	-	-	12.37	12.79	13.72
※	HTNB 2006-140-2		5.18	-	-	14.43	14.93	16.03
	HTNB 2006-160-2		4.71	-	-	16.50	17.07	18.32
※	HTNB 2006-200-2		3.99	-	-	20.64	21.34	22.92
	HTNB 2006-040-3		10.31	-	-	-	4.12	4.41
	HTNB 2006-060-3		8.67	-	-	-	6.19	6.64
	HTNB 2006-080-3		7.48	-	-	-	8.26	8.86
	HTNB 2006-100-3		6.57	-	-	-	10.34	11.09
	HTNB 2006-120-3		5.86	-	-	-	12.40	13.31
	HTNB 2006-160-3		4.82	-	-	-	16.54	17.76
※	HTNB 2008-060-1	R0.4	8.26	-	6.14	6.34	6.54	7.01
	HTNB 2008-080-1		7.04	-	8.21	8.47	8.75	9.38
	HTNB 2008-120-1		5.44	-	12.33	12.74	13.17	14.13
※	HTNB 2008-160-1		4.43	-	16.47	17.01	17.59	18.88
※	HTNB 2008-060-2		8.37	-	-	6.17	6.37	6.82
	HTNB 2008-080-2		7.16	-	-	8.23	8.51	9.12
	HTNB 2008-120-2		5.55	-	-	12.37	12.79	13.72
※	HTNB 2008-160-2		4.53	-	-	16.50	17.06	18.31
※	HTNB 2008-060-3		8.49	-	-	-	6.20	6.64
	HTNB 2008-080-3		7.28	-	-	-	8.26	8.86
	HTNB 2008-120-3		5.67	-	-	-	12.40	13.30
※	HTNB 2008-160-3		4.63	-	-	-	16.54	17.75

Next Page ➡

2 Flutes HARDMAX

	Model Number	Radius of Ball Nose R	Neck Taper Angle TN	Neck Length ℓ2	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Shape
※	HTNB 2010-060-1	R0.5	30′	6	1.5	0.8	0.95	16°	50	4	B
	HTNB 2010-080-1			8					50	4	
※	HTNB 2010-100-1			10					50	4	
	HTNB 2010-120-1			12					50	4	
	HTNB 2010-160-1			16					50	4	
	HTNB 2010-200-1			20					60	4	
	HTNB 2010-220-1			22					60	4	
	HTNB 2010-260-1			26					65	4	
	HTNB 2010-320-1			32					70	4	
	HTNB 2010-360-1			36					80	4	
※	HTNB 2010-060-2		1°	6					50	4	
	HTNB 2010-080-2			8					50	4	
※	HTNB 2010-100-2			10					50	4	
	HTNB 2010-120-2			12					50	4	
※	HTNB 2010-140-2			14					50	4	
	HTNB 2010-160-2			16					50	4	
※	HTNB 2010-180-2			18					50	4	
	HTNB 2010-200-2			20					60	4	
	HTNB 2010-220-2			22					60	4	
	HTNB 2010-260-2			26					65	4	
	HTNB 2010-320-2			32					70	4	
	HTNB 2010-360-2			36					80	4	
※	HTNB 2010-060-3		1°30′	6					50	4	
	HTNB 2010-080-3			8					50	4	
※	HTNB 2010-100-3			10					50	4	
	HTNB 2010-120-3			12					50	4	
	HTNB 2010-160-3			16					50	4	
	HTNB 2010-200-3			20					60	4	
	HTNB 2010-220-3			22					60	4	
	HTNB 2010-260-3			26					65	4	
	HTNB 2010-320-3			32					70	4	
	HTNB 2010-360-3			36					80	4	

Unit（mm）

	Model Number	Radius of Ball Nose R	Interference Angle	Effective Length by Inclined Angles - : Interference				
				30′	1°	1°30′	2°	3°
※	HTNB 2010-060-1	R0.5	8.06	-	6.14	6.33	6.54	7.00
	HTNB 2010-080-1		6.84	-	8.21	8.47	8.75	9.37
※	HTNB 2010-100-1		5.93	-	10.27	10.60	10.96	11.74
	HTNB 2010-120-1		5.24	-	12.33	12.73	13.16	14.11
	HTNB 2010-160-1		4.25	-	16.46	17.00	17.58	18.86
	HTNB 2010-200-1		3.57	-	20.60	21.27	22.00	23.61
	HTNB 2010-220-1		3.31	-	22.66	23.41	24.20	25.98
	HTNB 2010-260-1		2.88	-	26.79	27.67	28.62	No Interference
	HTNB 2010-320-1		2.41	-	32.98	34.07	35.24	No Interference
	HTNB 2010-360-1		2.18	-	37.11	38.34	39.66	No Interference
※	HTNB 2010-060-2		8.17	-	-	6.18	6.38	6.82
	HTNB 2010-080-2		6.95	-	-	8.24	8.51	9.12
※	HTNB 2010-100-2		6.04	-	-	10.31	10.66	11.42
	HTNB 2010-120-2		5.35	-	-	12.38	12.79	13.72
※	HTNB 2010-140-2		4.79	-	-	14.45	14.93	16.02
	HTNB 2010-160-2		4.34	-	-	16.51	17.07	18.31
※	HTNB 2010-180-2		3.97	-	-	18.58	19.21	20.61
	HTNB 2010-200-2		3.65	-	-	20.64	21.35	22.91
	HTNB 2010-220-2		3.39	-	-	22.71	23.48	25.21
	HTNB 2010-260-2		2.95	-	-	26.85	27.76	No Interference
	HTNB 2010-320-2		2.48	-	-	33.05	34.18	No Interference
	HTNB 2010-360-2		2.24	-	-	37.18	38.46	No Interference
※	HTNB 2010-060-3		8.28	-	-	-	6.21	6.65
	HTNB 2010-080-3		7.06	-	-	-	8.28	8.87
※	HTNB 2010-100-3		6.16	-	-	-	10.35	11.10
	HTNB 2010-120-3		5.45	-	-	-	12.42	13.32
	HTNB 2010-160-3		4.44	-	-	-	16.56	17.77
	HTNB 2010-200-3		3.74	-	-	-	20.70	22.21
	HTNB 2010-220-3		3.47	-	-	-	22.77	24.44
	HTNB 2010-260-3		3.03	-	-	-	26.91	28.88
	HTNB 2010-320-3		2.55	-	-	-	33.11	No Interference
	HTNB 2010-360-3		2.30	-	-	-	37.25	No Interference

Next Page ➡

2 Flutes HARDMAX

	Model Number	Radius of Ball Nose R	Neck Taper Angle TN	Neck Length ℓ2	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Shape
	HTNB 2015-100-1	R0.75	30′	10	2.25	1.2	1	16°	60	4	B
	HTNB 2015-120-1			12					60	4	
	HTNB 2015-160-1			16					60	4	
	HTNB 2015-200-1			20					60	4	
※	HTNB 2015-220-1			22					60	4	
	HTNB 2015-260-1			26					70	4	
	HTNB 2015-300-1			30					70	4	
	HTNB 2015-360-1			36					80	4	
	HTNB 2015-120-2		1°	10					60	4	
	HTNB 2015-120-2			12					60	4	
	HTNB 2015-160-2			16					60	4	
	HTNB 2015-200-2			20					60	4	
	HTNB 2015-260-2			26					70	4	
	HTNB 2015-300-2			30					70	4	
	HTNB 2015-360-3			36					80	4	
	HTNB 2020-120-1		1°30′	10					60	4	
	HTNB 2015-120-3			12					60	4	
	HTNB 2015-160-3			16					60	4	
	HTNB 2015-200-3			20					60	4	
	HTNB 2015-260-3			26					70	4	
	HTNB 2015-300-3			30					70	4	
	HTNB 2015-360-3			36					80	4	
※	HTNB 2020-120-1	R1	30′	12	3	1.6	1.91	16°	60	4	B
	HTNB 2020-160-1			16					60	4	
	HTNB 2020-200-1			20					60	4	
	HTNB 2020-220-1			22					60	4	
※	HTNB 2020-240-1			24					60	4	
	HTNB 2020-260-1			26					60	4	
※	HTNB 2020-280-1			28					70	4	
	HTNB 2020-300-1			30					70	4	
	HTNB 2020-320-1			32					70	4	
※	HTNB 2020-340-1			34					70	4	
	HTNB 2020-360-1			36					80	4	
	HTNB 2020-400-1			40					80	4	
※	HTNB 2020-100-2		1°	10					60	4	
※	HTNB 2020-120-2			12					60	4	
	HTNB 2020-160-2			16					60	4	
	HTNB 2020-200-2			20					60	4	
	HTNB 2020-220-2			22					60	4	
※	HTNB 2020-240-2			24					60	4	
	HTNB 2020-260-2			26					60	4	
※	HTNB 2020-280-2			28					70	4	
	HTNB 2020-300-2			30					70	4	
	HTNB 2020-320-2			32					70	4	
※	HTNB 2020-340-2			34					70	4	
	HTNB 2020-360-2			36					80	4	
	HTNB 2020-400-2			40					80	4	
※	HTNB 2020-120-3		1°30′	12					60	4	
	HTNB 2020-160-3			16					60	4	
	HTNB 2020-200-3			20					60	4	
	HTNB 2020-220-3			22					60	4	
※	HTNB 2020-240-3			24					60	4	
	HTNB 2020-260-3			26					60	4	
※	HTNB 2020-280-3			28					70	4	
	HTNB 2020-300-3			30					70	4	
	HTNB 2020-320-3			32					70	4	
※	HTNB 2020-340-3			34					70	4	
	HTNB 2020-360-3			36					80	4	
	HTNB 2020-400-3			40					80	4	

Unit（mm）

	Model Number	Radius of Ball Nose R	Interference Angle	Effective Length by Inclined Angles - : Interference				
				30′	1°	1°30′	2°	3°
	HTNB 2015-100-1	R0.75	5.36	-	10.27	10.59	10.93	11.70
	HTNB 2015-120-1		4.69	-	12.33	12.72	13.14	14.08
	HTNB 2015-160-1		3.75	-	16.46	16.99	17.56	18.82
	HTNB 2015-200-1		3.12	-	20.59	21.26	21.98	23.57
※	HTNB 2015-220-1		2.88	-	22.66	23.39	24.18	No Interference
	HTNB 2015-260-1		2.50	-	26.79	27.66	28.60	No Interference
	HTNB 2015-300-1		2.20	-	30.92	31.93	33.01	No Interference
	HTNB 2015-360-1		1.87	-	37.11	38.33	No Interference	No Interference
	HTNB 2015-120-2		5.46	-	-	10.31	10.65	11.39
	HTNB 2015-120-2		4.79	-	-	12.38	12.78	13.69
	HTNB 2015-160-2		3.83	-	-	16.51	17.06	18.29
	HTNB 2015-200-2		3.20	-	-	20.65	21.34	22.89
	HTNB 2015-260-2		2.56	-	-	26.85	27.76	No Interference
	HTNB 2015-300-2		2.26	-	-	30.98	32.03	No Interference
	HTNB 2015-360-3		1.92	-	-	37.18	No Interference	No Interference
	HTNB 2020-120-1		5.57	-	-	-	10.36	11.09
	HTNB 2015-120-3		4.89	-	-	-	12.43	13.31
	HTNB 2015-160-3		3.92	-	-	-	16.57	17.76
	HTNB 2015-200-3		3.28	-	-	-	20.71	22.21
	HTNB 2015-260-3		2.63	-	-	-	26.91	No Interference
	HTNB 2015-300-3		2.32	-	-	-	31.05	No Interference
	HTNB 2015-360-3		1.98	-	-	-	No Interference	No Interference
※	HTNB 2020-120-1	R1	4.05	-	12.34	12.72	13.14	14.05
	HTNB 2020-160-1		3.19	-	16.47	16.99	17.55	18.80
	HTNB 2020-200-1		2.63	-	20.60	21.26	21.97	No Interference
	HTNB 2020-220-1		2.42	-	22.66	23.39	24.17	No Interference
※	HTNB 2020-240-1		2.23	-	24.73	25.53	26.38	No Interference
	HTNB 2020-260-1		2.08	-	26.79	27.66	28.59	No Interference
※	HTNB 2020-280-1		1.94	-	28.86	29.80	No Interference	No Interference
	HTNB 2020-300-1		1.83	-	30.92	31.93	No Interference	No Interference
	HTNB 2020-320-1		1.72	-	32.99	34.07	No Interference	No Interference
※	HTNB 2020-340-1		1.63	-	35.05	36.20	No Interference	No Interference
	HTNB 2020-360-1		1.54	-	37.12	38.33	No Interference	No Interference
	HTNB 2020-400-1		1.40	-	41.25	No Interference	No Interference	No Interference
※	HTNB 2020-100-2		4.77	-	-	10.34	10.66	11.40
※	HTNB 2020-120-2		4.13	-	-	12.40	12.80	13.69
	HTNB 2020-160-2		3.26	-	-	16.53	17.08	18.29
	HTNB 2020-200-2		2.69	-	-	20.67	21.35	No Interference
	HTNB 2020-220-2		2.48	-	-	22.73	23.49	No Interference
※	HTNB 2020-240-2		2.29	-	-	24.80	25.63	No Interference
	HTNB 2020-260-2		2.13	-	-	26.87	27.77	No Interference
※	HTNB 2020-280-2		2.00	-	-	28.94	29.91	No Interference
	HTNB 2020-300-2		1.88	-	-	31.00	No Interference	No Interference
	HTNB 2020-320-2		1.77	-	-	33.07	No Interference	No Interference
※	HTNB 2020-340-2		1.67	-	-	35.14	No Interference	No Interference
	HTNB 2020-360-2		1.59	-	-	37.20	No Interference	No Interference
	HTNB 2020-400-2		1.44	-	-	No Interference	No Interference	No Interference
※	HTNB 2020-120-3		4.22	-	-	-	12.46	13.33
	HTNB 2020-160-3		3.34	-	-	-	16.60	17.78
	HTNB 2020-200-3		2.76	-	-	-	20.74	No Interference
	HTNB 2020-220-3		2.54	-	-	-	22.81	No Interference
※	HTNB 2020-240-3		2.35	-	-	-	24.88	No Interference
	HTNB 2020-260-3		2.19	-	-	-	26.95	No Interference
※	HTNB 2020-280-3		2.05	-	-	-	29.02	No Interference
	HTNB 2020-300-3		1.93	-	-	-	No Interference	No Interference
	HTNB 2020-320-3		1.82	-	-	-	No Interference	No Interference
※	HTNB 2020-340-3		1.72	-	-	-	No Interference	No Interference
	HTNB 2020-360-3		1.63	-	-	-	No Interference	No Interference
	HTNB 2020-400-3		1.48	-	-	-	No Interference	No Interference

Next Page ➡

2 Flutes HARDMAX

	Model Number	Radius of Ball Nose R	Neck Taper Angle TN	Neck Length ℓ2	Effective Length ℓ1	Length of Cut ℓ	Neck Diameter Ød1	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Shape
	HTNB 2030-200-1	R1.5	30′	20	4.5	2.4	2.89	16°	60	4	B
※	HTNB 2030-220-1			22					60	6	
	HTNB 2030-260-1			26					70	6	
	HTNB 2030-300-1			30					70	6	
	HTNB 2030-320-1			32					70	6	
	HTNB 2030-360-1			36					80	6	
	HTNB 2030-400-1			40					80	6	
	HTNB 2030-420-1			42					90	6	
	HTNB 2030-520-1			52					100	6	
	HTNB 2030-200-2		1°	20					60	6	
	HTNB 2030-260-2			26					70	6	
	HTNB 2030-300-2			30					70	6	
	HTNB 2030-320-2			32					70	6	
	HTNB 2030-360-2			36					80	6	
	HTNB 2030-400-2			40					80	6	
	HTNB 2030-420-2			42					90	6	
※	HTNB 2030-480-2			48					100	6	
	HTNB 2030-520-2			52					100	6	
※	HTNB 2030-620-2			62					100	6	
	HTNB 2030-200-3		1°30′	20					60	6	
	HTNB 2030-260-3			26					70	6	
	HTNB 2030-300-3			30					70	6	
	HTNB 2030-320-3			32					70	6	
	HTNB 2030-360-3			36					80	6	
	HTNB 2030-400-3			40					80	6	
	HTNB 2030-420-3			42					90	6	
	HTNB 2030-580-3			58					100	6	
※	HTNB 2040-300-1	R2	30′	30	6	0.2	3.9	16°	80	6	B
※	HTNB 2040-200-2		1°	20					80	6	
※	HTNB 2040-300-2			30					80	6	
※	HTNB 2040-360-2			36					80	6	
	HTNB 2040-400-1		30′	40					80	6	
	HTNB 2040-620-1			62					120	6	
	HTNB 2040-400-2		1°	40					80	6	
	HTNB 2040-600-2			60					120	6	
	HTNB 2040-410-3		1°30′	41					80	6	
※	HTNB 2040-800-3			80		3		-	130	8	C

※Additional model

Unit（mm）

	Model Number	Radius of Ball Nose R	Interference Angle	Effective Length by Inclined Angles - : Interference				
				30′	1°	1°30′	2°	3°
	HTNB 2030-200-1	R1.5	3.71	-	20.59	21.23	21.92	23.46
※	HTNB 2030-220-1		3.43	-	22.65	23.36	24.13	25.83
	HTNB 2030-260-1		2.97	-	26.78	27.63	28.54	No Interference
	HTNB 2030-300-1		2.62	-	30.91	31.90	32.96	No Interference
	HTNB 2030-320-1		2.48	-	32.98	34.04	35.17	No Interference
	HTNB 2030-360-1		2.23	-	37.11	38.30	39.58	No Interference
	HTNB 2030-400-1		2.03	-	41.23	42.57	44.00	No Interference
	HTNB 2030-420-1		1.94	-	43.30	44.70	No Interference	No Interference
	HTNB 2030-520-1		1.60	-	53.62	55.38	No Interference	No Interference
	HTNB 2030-200-2		3.79	-	-	20.66	21.33	22.83
	HTNB 2030-260-2		3.04	-	-	26.87	27.75	29.72
	HTNB 2030-300-2		2.69	-	-	31.00	32.03	No Interference
	HTNB 2030-320-2		2.54	-	-	33.07	34.17	No Interference
	HTNB 2030-360-2		2.29	-	-	37.20	38.44	No Interference
	HTNB 2030-400-2		2.08	-	-	41.33	42.72	No Interference
	HTNB 2030-420-2		1.99	-	-	43.40	No Interference	No Interference
※	HTNB 2030-480-2		1.77	-	-	49.60	No Interference	No Interference
	HTNB 2030-520-2		1.64	-	-	53.74	No Interference	No Interference
※	HTNB 2030-620-2		1.39	-	-	No Interference	No Interference	No Interference
	HTNB 2030-200-3		3.88	-	-	-	20.75	22.20
	HTNB 2030-260-3		3.12	-	-	-	26.96	28.87
	HTNB 2030-300-3		2.76	-	-	-	31.09	No Interference
	HTNB 2030-320-3		2.61	-	-	-	33.16	No Interference
	HTNB 2030-360-3		2.35	-	-	-	37.30	No Interference
	HTNB 2030-400-3		2.14	-	-	-	41.44	No Interference
	HTNB 2030-420-3		2.05	-	-	-	43.51	No Interference
	HTNB 2030-580-3		1.53	-	-	-	No Interference	No Interference
※	HTNB 2040-300-1	R2	1.88	-	30.91	31.88	No Interference	No Interference
※	HTNB 2040-200-2		2.81	-	-	20.67	21.32	No Interference
※	HTNB 2040-300-2		1.93	-	-	31.00	No Interference	No Interference
※	HTNB 2040-360-2		1.63	-	-	37.21	No Interference	No Interference
	HTNB 2040-400-1		1.43	-	41.23	No Interference	No Interference	No Interference
	HTNB 2040-620-1		0.94	-	No Interference	No Interference	No Interference	No Interference
	HTNB 2040-400-2		1.47	-	-	No Interference	No Interference	No Interference
	HTNB 2040-600-2		1.00	-	-	No Interference	No Interference	No Interference
	HTNB 2040-410-3		1.48	-	-	-	No Interference	No Interference
※	HTNB 2040-800-3		-	-	-	-	No Interference	No Interference

※Additional model

Milling Conditions for HTNB

WORK MATERIAL			COPPER / CARBON STEELS Cu / S45C / S50C					PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30～45HRC)				
Model Number	Radius of Ball Nose (mm)	Neck Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth		Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth	
						Roughing (mm)	Finishing (mm)				Roughing (mm)	Finishing (mm)
2002	R0.1	1.5	42,000	640	0.008	0.02	0.015	29,000	430	0.006	0.02	0.015
		2	33,000	370	0.006	0.02	0.011	23,500	260	0.005	0.02	0.011
		3	27,000	270	0.002	0.02	0.010	19,000	165	0.001	0.02	0.009
2003	R0.15	2	36,000	650	0.009	0.03	0.018	25,200	400	0.007	0.03	0.016
		3	33,000	500	0.004	0.03	0.015	23,000	330	0.003	0.03	0.014
2004	R0.2	3	42,000	1,300	0.018	0.04	0.031	29,000	800	0.014	0.04	0.028
		4	33,000	800	0.008	0.04	0.024	23,000	520	0.006	0.04	0.023
		6	27,000	550	0.005	0.04	0.020	19,000	330	0.004	0.04	0.017
2005	R0.25	4	36,000	1,330	0.020	0.05	0.037	28,000	870	0.016	0.05	0.031
		6	29,000	900	0.012	0.05	0.031	23,000	650	0.009	0.05	0.028
		8	23,500	600	0.007	0.05	0.026	19,000	450	0.006	0.05	0.024
		10	20,000	480	0.004	0.05	0.024	18,000	380	0.003	0.05	0.021
2006	R0.3	4	44,000	2,340	0.032	0.06	0.053	32,500	1,500	0.025	0.06	0.046
		6	36,000	1,500	0.018	0.06	0.042	29,000	1,100	0.014	0.06	0.038
		8	28,500	1,150	0.018	0.06	0.040	24,000	770	0.014	0.06	0.032
		10	28,500	950	0.014	0.06	0.033	24,000	720	0.011	0.06	0.030
		12	28,500	950	0.009	0.06	0.033	24,000	720	0.007	0.06	0.030
		14	26,500	800	0.007	0.06	0.030	23,000	660	0.005	0.06	0.029
		16	25,000	700	0.005	0.06	0.028	22,000	600	0.004	0.06	0.027
		20	20,000	400	0.003	0.06	0.020	17,000	330	0.002	0.06	0.019
2008	R0.4	6	36,000	2,000	0.023	0.08	0.056	24,000	1,300	0.019	0.08	0.054
		8	28,500	1,500	0.023	0.08	0.053	20,000	950	0.019	0.08	0.048
		12	28,500	1,200	0.018	0.08	0.042	16,500	600	0.014	0.08	0.036
		16	25,000	900	0.010	0.08	0.036	15,000	500	0.008	0.08	0.033
2010	R0.5	6	35,000	2,900	0.050	0.1	0.083	23,000	1,850	0.040	0.1	0.080
		8	28,000	2,200	0.050	0.1	0.079	19,000	1,500	0.040	0.1	0.079
		10	24,000	1,800	0.035	0.1	0.075	17,000	1,300	0.030	0.1	0.076
		12	19,000	1,360	0.027	0.1	0.072	14,000	1,000	0.022	0.1	0.071
		14	18,000	1,200	0.025	0.1	0.067	13,000	900	0.020	0.1	0.069
		16	18,000	1,150	0.025	0.1	0.064	13,000	850	0.020	0.1	0.065
		18	17,500	1,120	0.018	0.1	0.064	12,500	800	0.013	0.1	0.064
		20	17,000	1,100	0.016	0.1	0.065	12,000	800	0.013	0.1	0.067
		22	17,000	1,100	0.016	0.1	0.065	12,000	800	0.013	0.1	0.067
		26	16,000	1,000	0.015	0.1	0.063	11,000	700	0.012	0.1	0.064
		32	12,000	750	0.011	0.1	0.063	9,000	550	0.009	0.1	0.061
		36	10,000	620	0.009	0.1	0.062	7,000	420	0.007	0.1	0.060
2015	R0.75	10	20,000	2,300	0.065	0.15	0.115	13,000	1,600	0.050	0.15	0.123
		12	18,000	2,000	0.055	0.15	0.111	13,000	1,500	0.045	0.15	0.115
		16	16,000	1,600	0.050	0.15	0.100	12,000	1,200	0.030	0.15	0.100
		20	14,000	1,400	0.035	0.15	0.100	10,000	950	0.025	0.15	0.095
		22	14,000	1,400	0.035	0.15	0.100	10,000	950	0.025	0.15	0.095
		26	12,000	1,200	0.025	0.15	0.100	10,000	900	0.020	0.15	0.090
		30	10,000	950	0.020	0.15	0.095	8,000	700	0.015	0.15	0.088
		36	10,000	950	0.020	0.15	0.095	7,000	600	0.015	0.15	0.086

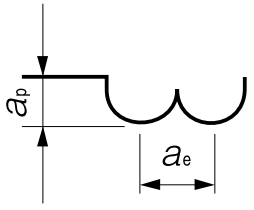
Milling Conditions for HTNB

WORK MATERIAL			HARDENED STEELS SKD / SKT (45~55HRC)					HARDENED STEELS SKD / SKS (55~65HRC)				
Model Number	Radius of Ball Nose (mm)	Neck Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth		Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth	
						Roughing (mm)	Finishing (mm)				Roughing (mm)	Finishing (mm)
2002	R0.1	1.5	28,000	330	0.006	0.016	0.012	28,000	260	0.005	0.012	0.009
		2	22,000	210	0.004	0.016	0.010	22,000	190	0.004	0.012	0.009
		3	17,500	150	0.001	0.016	0.009	17,500	130	0.001	0.012	0.007
2003	R0.15	2	23,500	350	0.006	0.024	0.015	23,500	300	0.005	0.018	0.013
		3	21,500	250	0.003	0.024	0.012	21,500	200	0.002	0.018	0.009
2004	R0.2	3	27,000	670	0.012	0.032	0.025	27,000	500	0.010	0.024	0.019
		4	22,000	430	0.006	0.032	0.020	22,000	380	0.005	0.024	0.017
		6	18,000	300	0.004	0.032	0.017	18,000	260	0.003	0.024	0.014
2005	R0.25	4	27,500	650	0.014	0.04	0.024	27,500	625	0.011	0.03	0.023
		6	22,000	530	0.008	0.04	0.024	22,000	500	0.007	0.03	0.023
		8	17,000	380	0.005	0.04	0.022	17,000	350	0.004	0.03	0.021
		10	16,000	330	0.002	0.04	0.021	16,000	300	0.002	0.03	0.019
2006	R0.3	4	25,500	850	0.022	0.048	0.033	25,500	713	0.018	0.036	0.028
		6	21,000	700	0.012	0.048	0.033	21,000	550	0.010	0.036	0.026
		8	17,000	510	0.012	0.048	0.030	17,000	425	0.010	0.036	0.025
		10	17,000	470	0.009	0.048	0.028	16,000	390	0.008	0.036	0.024
		12	16,000	400	0.006	0.048	0.025	15,000	350	0.005	0.036	0.023
		14	15,500	370	0.004	0.048	0.024	14,500	320	0.004	0.036	0.022
		16	15,000	350	0.003	0.048	0.023	14,500	300	0.003	0.036	0.021
		20	12,000	200	0.001	0.048	0.017	11,000	180	0.001	0.036	0.016
2008	R0.4	6	21,000	900	0.016	0.064	0.043	21,000	800	0.013	0.048	0.038
		8	17,000	680	0.016	0.064	0.040	17,000	600	0.013	0.048	0.035
		12	14,000	480	0.012	0.064	0.034	14,000	420	0.010	0.048	0.030
		16	13,000	420	0.006	0.064	0.032	12,500	350	0.006	0.048	0.028
2010	R0.5	6	23,000	1,500	0.034	0.08	0.065	22,000	1,200	0.028	0.06	0.055
		8	19,000	1,130	0.034	0.08	0.059	18,000	920	0.028	0.06	0.051
		10	16,000	950	0.027	0.08	0.059	15,500	770	0.022	0.06	0.050
		12	12,600	760	0.019	0.08	0.060	12,600	615	0.015	0.06	0.049
		14	12,000	700	0.017	0.08	0.058	12,000	540	0.014	0.06	0.045
		16	12,000	700	0.017	0.08	0.058	12,000	540	0.014	0.06	0.045
		18	11,000	640	0.011	0.08	0.058	11,000	490	0.010	0.06	0.045
		20	11,000	640	0.011	0.08	0.058	11,000	490	0.009	0.06	0.045
		22	11,000	640	0.011	0.08	0.058	11,000	490	0.009	0.06	0.045
		26	10,000	570	0.010	0.08	0.057	10,000	460	0.009	0.06	0.046
		32	9,000	490	0.008	0.08	0.054	9,000	380	0.007	0.06	0.042
		36	7,000	380	0.006	0.08	0.054	7,000	280	0.005	0.06	0.040
2015	R0.75	10	13,000	1,200	0.040	0.12	0.092	13,000	950	0.035	0.09	0.073
		12	11,000	950	0.035	0.12	0.086	11,000	750	0.030	0.09	0.068
		16	11,000	900	0.030	0.12	0.082	11,000	750	0.025	0.09	0.068
		20	10,000	800	0.020	0.12	0.080	10,000	650	0.018	0.09	0.065
		22	10,000	800	0.020	0.12	0.080	10,000	650	0.018	0.09	0.065
		26	9,000	700	0.017	0.12	0.078	9,000	600	0.015	0.09	0.067
		30	8,000	600	0.013	0.12	0.075	8,000	500	0.013	0.09	0.063
		36	7,000	500	0.013	0.12	0.071	7,000	400	0.013	0.09	0.057

Milling Conditions for HTNB

WORK MATERIAL			COPPER / CARBON STEELS Cu / S45C / S50C					PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30~45HRC)				
Model Number	Radius of Ball Nose (mm)	Neck Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth Roughing (mm)	a_e Radial Depth Finishing (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth Roughing (mm)	a_e Radial Depth Finishing (mm)
2020	R1	10	19,000	3,300	0.110	0.2	0.174	12,000	2,100	0.100	0.2	0.175
		12	17,000	2,900	0.090	0.2	0.171	12,000	2,000	0.095	0.2	0.167
		16	15,000	2,350	0.081	0.2	0.157	11,000	1,700	0.065	0.2	0.155
		20	11,000	1,600	0.068	0.2	0.145	8,400	1,100	0.055	0.2	0.131
		22	11,000	1,600	0.063	0.2	0.145	8,400	1,050	0.050	0.2	0.125
		24	11,000	1,500	0.063	0.2	0.136	8,400	1,050	0.050	0.2	0.125
		26	10,000	1,350	0.063	0.2	0.135	7,350	900	0.050	0.2	0.122
		28	10,000	1,350	0.050	0.2	0.135	7,350	870	0.038	0.2	0.118
		30	10,000	1,350	0.050	0.2	0.135	7,350	870	0.038	0.2	0.118
		32	10,000	1,350	0.041	0.2	0.135	7,350	850	0.032	0.2	0.116
		34	10,000	1,350	0.041	0.2	0.135	7,000	800	0.032	0.2	0.114
		36	10,000	1,350	0.041	0.2	0.135	7,000	800	0.032	0.2	0.114
		40	10,000	1,350	0.041	0.2	0.135	7,000	800	0.032	0.2	0.114
2030	R1.5	20	11,000	2,350	0.095	0.3	0.214	8,400	1,500	0.075	0.3	0.179
		22	11,000	2,350	0.090	0.3	0.214	8,400	1,500	0.071	0.3	0.179
		26	10,000	2,050	0.085	0.3	0.205	7,600	1,300	0.068	0.3	0.171
		30	10,000	2,000	0.081	0.3	0.200	7,500	1,250	0.065	0.3	0.167
		32	10,000	1,900	0.081	0.3	0.190	7,500	1,200	0.065	0.3	0.160
		36	9,000	1,700	0.073	0.3	0.189	6,000	950	0.058	0.3	0.158
		40	8,500	1,600	0.065	0.3	0.188	6,000	950	0.053	0.3	0.158
		42	8,500	1,600	0.063	0.3	0.188	6,000	950	0.050	0.3	0.158
		48	8,500	1,570	0.052	0.3	0.185	6,000	920	0.042	0.3	0.153
		52	8,500	1,550	0.045	0.3	0.182	6,000	900	0.036	0.3	0.150
		62	5,600	930	0.035	0.3	0.166	5,000	700	0.025	0.3	0.140
2040	R2	20	8,400	1,900	0.125	0.4	0.226	5,400	1,030	0.096	0.4	0.191
		30	7,600	1,600	0.100	0.4	0.211	4,800	850	0.083	0.4	0.177
		36	6,900	1,400	0.094	0.4	0.203	3,900	650	0.074	0.4	0.167
		40	6,500	1,300	0.086	0.4	0.200	3,900	650	0.068	0.4	0.167
		41	6,500	1,300	0.086	0.4	0.200	3,900	650	0.068	0.4	0.167
		60	4,300	780	0.063	0.4	0.181	3,300	500	0.050	0.4	0.152
		62	4,300	750	0.063	0.4	0.174	3,300	480	0.050	0.4	0.145
		80	4,300	750	0.063	0.4	0.174	3,300	480	0.050	0.4	0.145
Radial Depth (mm)		Roughing	$a_e \leq 0.1D$					$a_e \leq 0.1D$				
		Finishing	$a_e \leq V_f / n$									

a_p : Axial Depth (mm)
a_e : Radial Depth (mm)
D : Outside Diameter (mm)
n : Spindle Speed (min^{-1})
V_f : Feed Rate (mm/min)



Milling Conditions for HTNB

WORK MATERIAL			HARDENED STEELS SKD / SKT (45~55HRC)					HARDENED STEELS SKD / SKS (55~65HRC)				
Model Number	Radius of Ball Nose (mm)	Neck Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth		Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth	
						Roughing (mm)	Finishing (mm)				Roughing (mm)	Finishing (mm)
2020	R1	10	12,000	1,800	0.074	0.16	0.150	12,000	1,350	0.064	0.12	0.113
		12	10,500	1,430	0.065	0.16	0.136	10,500	1,070	0.055	0.12	0.102
		16	10,500	1,360	0.056	0.16	0.130	10,500	1,070	0.046	0.12	0.102
		20	9,450	1,150	0.048	0.16	0.122	9,450	920	0.038	0.12	0.097
		22	9,450	1,150	0.043	0.16	0.122	9,450	920	0.036	0.12	0.097
		24	8,400	1,020	0.043	0.16	0.121	8,400	800	0.036	0.12	0.095
		26	8,400	1,020	0.043	0.16	0.121	8,400	800	0.036	0.12	0.095
		28	7,350	850	0.033	0.16	0.116	7,350	690	0.028	0.12	0.094
		30	7,350	850	0.033	0.16	0.116	7,350	690	0.028	0.12	0.094
		32	7,350	850	0.028	0.16	0.116	7,350	690	0.023	0.12	0.094
		34	6,500	745	0.028	0.16	0.115	6,500	610	0.023	0.12	0.094
		36	6,500	745	0.028	0.16	0.115	6,500	610	0.023	0.12	0.094
		40	6,500	745	0.028	0.16	0.115	6,500	610	0.023	0.12	0.094
2030	R1.5	20	8,000	1,400	0.065	0.24	0.175	8,000	1,200	0.053	0.18	0.150
		22	8,000	1,400	0.062	0.24	0.175	8,000	1,200	0.050	0.18	0.150
		26	7,500	1,200	0.060	0.24	0.160	7,500	1,050	0.048	0.18	0.140
		30	7,000	1,100	0.057	0.24	0.157	7,000	980	0.047	0.18	0.140
		32	7,000	1,100	0.056	0.24	0.157	7,000	950	0.046	0.18	0.136
		36	6,000	950	0.050	0.24	0.158	6,000	800	0.042	0.18	0.133
		40	5,500	850	0.045	0.24	0.155	5,500	750	0.038	0.18	0.136
		42	5,500	850	0.043	0.24	0.155	5,500	750	0.036	0.18	0.136
		48	5,500	820	0.035	0.24	0.149	5,500	720	0.030	0.18	0.131
		52	5,500	800	0.031	0.24	0.145	5,500	700	0.026	0.18	0.127
		62	4,700	600	0.023	0.24	0.128	4,700	530	0.021	0.18	0.113
2040	R2	20	5,200	980	0.085	0.32	0.188	5,200	840	0.066	0.24	0.162
		30	4,500	770	0.074	0.32	0.171	4,500	690	0.059	0.24	0.153
		36	3,900	670	0.065	0.32	0.172	3,900	560	0.052	0.24	0.144
		40	3,600	600	0.059	0.32	0.167	3,600	530	0.048	0.24	0.147
		41	3,600	600	0.059	0.32	0.167	3,600	530	0.048	0.24	0.147
		60	3,100	450	0.043	0.32	0.145	3,100	400	0.036	0.24	0.129
		62	3,100	420	0.043	0.32	0.135	3,100	380	0.036	0.24	0.123
		80	2,900	340	0.035	0.32	0.117	2,500	200	0.020	0.24	0.080
Radial Depth (mm)		Roughing	$a_e \leq 0.08D$					$a_e \leq 0.06D$				
		Finishing	$a_e \leq V_f / n$									

Note:
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
- The neck length and taper angle may affect the milling parameters. In operation, fine adjustments may be required.
- Recommend air blow or oil mist.
- Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
- Recommend water soluble or oil base coolant for Copper.

Size **R0.5~R2**

HFTNB

NEW

Super MG | HARD MAX | 40° | R ±0.005 (R0.5~R1.5) | R ±0.007 (R2) | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

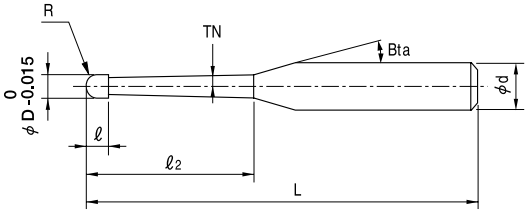
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
○	○	◎	◎	◎	◎ ~65HRC	○			◎			○	○		

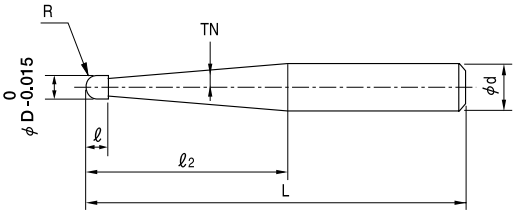
Features

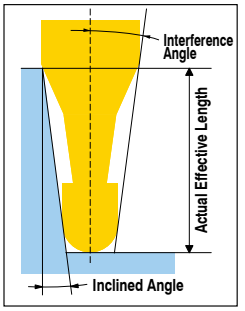
3 Flute Taper Neck Ball End Mills for Hard Materials.
The negative rake angle design improves wear resistance.
Back taper design reduces cutting resistance.
Suitable for both roughing and finishing. Diameter Tolerance : 0/-0.015.

Shape A



Shape B

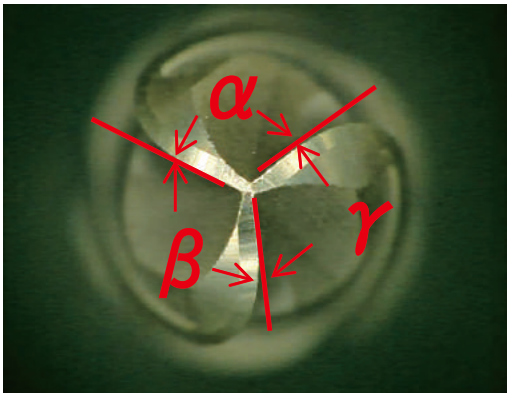




The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

■ Variable Pitch design

Minimizing vibration and chattering



※Variable Pitch $\alpha \neq \beta \neq \gamma$

■ A wide choice of Taper Neck Angles

Useful sizes: 0.4° · 0.9° · 1.4° · 1.9° · 2.9°
Using with HTNRS, Taper Neck Radius End Mill, offers higher efficient milling.

Total 73 models

Unit（mm）

Model Number	Radius of Ball Nose R	Neck Taper Angle TN	Neck Length ℓ2	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Shape	Interference Angle	Effective Length by Inclined Angles — : Interference				
										30′	1°	1°30′	2°	3°
HFTNB 3010-080-08	R0.5	0.4°	8	0.8	16°	60	6	A	8.82°	8.05	8.30	8.57	8.85	9.48
HFTNB 3010-100-08			10			60	6		7.89°	10.07	10.38	10.71	11.07	11.87
HFTNB 3010-120-08			12			60	6		7.13°	12.08	12.46	12.86	13.29	14.26
HFTNB 3010-160-08			16			60	6		5.98°	16.10	16.61	17.16	17.74	19.03
HFTNB 3010-200-08			20			60	6		5.15°	20.13	20.77	21.45	22.18	23.81
HFTNB 3010-260-08			26			70	6		4.26°	26.17	27.00	27.89	28.85	30.97
HFTNB 3010-300-08			30			70	6		3.82°	30.19	31.16	32.19	33.29	35.75
HFTNB 3010-060-18		0.9°	6			60	6		10.11°	-	6.06	6.25	6.45	6.90
HFTNB 3010-080-18			8			60	6		8.94°	-	8.07	8.33	8.60	9.21
HFTNB 3010-100-18			10			60	6		8.01°	-	10.08	10.41	10.75	11.53
HFTNB 3010-120-18			12			60	6		7.25°	-	12.10	12.49	12.91	13.84
HFTNB 3010-160-18			16			60	6		6.10°	-	16.12	16.65	17.21	18.47
HFTNB 3010-200-18			20			60	6		5.26°	-	20.15	20.81	21.52	23.09
HFTNB 3010-260-18			26			70	6		4.36°	-	26.19	27.05	27.98	30.03
HFTNB 3010-300-18			30			70	6		3.91°	-	30.21	31.21	32.28	34.66
HFTNB 3010-100-28		1.4°	10			60	6		8.13°	-	-	10.10	10.43	11.18
HFTNB 3010-120-28			12			60	6		7.38°	-	-	12.11	12.52	13.42
HFTNB 3010-160-28			16			60	6		6.22°	-	-	16.14	16.68	17.90
HFTNB 3010-200-28			20			60	6		5.37°	-	-	20.17	20.85	22.38
HFTNB 3010-260-28			26			70	6		4.46°	-	-	26.21	27.10	29.09
HFTNB 3015-100-08	R0.75	0.4°	10	1.2	16°	60	6	A	7.55°	10.11	10.41	10.74	11.09	11.87
HFTNB 3015-160-08			16			60	6		5.64°	16.14	16.65	17.18	17.75	19.03
HFTNB 3015-200-08			20			60	6		4.82°	20.17	20.80	21.48	22.20	23.81
HFTNB 3015-300-08			30			70	6		3.54°	30.23	31.19	32.21	33.31	35.75
HFTNB 3015-100-18		0.9°	10			60	6		7.66°	-	10.13	10.45	10.79	11.54
HFTNB 3015-160-18			16			60	6		5.75°	-	16.17	16.69	17.24	18.48
HFTNB 3015-200-18			20			60	6		4.93°	-	20.19	20.85	21.55	23.11
HFTNB 3015-300-18			30			70	6		3.63°	-	30.26	31.25	32.31	34.67
HFTNB 3015-100-28		1.4°	10			60	6		7.79°	-	-	10.15	10.48	11.21
HFTNB 3015-160-28			16			60	6		5.87°	-	-	16.19	16.73	17.93
HFTNB 3015-200-28			20			60	6		5.03°	-	-	20.22	20.90	22.41
HFTNB 3015-300-28			30			80	6		3.72°	-	-	30.28	31.31	33.60

3 Flutes HARDMAX

Unit (mm)

Model Number	Radius of Ball Nose R	Neck Taper Angle TN	Neck Length ℓ2	Length of Cut ℓ	Shank Taper Angle Bta	Overall Length L	Shank Diameter Ød	Shape	Interference Angle	Effective Length by Inclined Angles — : Interference				
										30′	1°	1°30′	2°	3°
HFTNB 3020-120-08	R1	0.4°	12	1.6	16°	60	6	A	6.40°	12.12	12.49	12.87	13.29	14.22
HFTNB 3020-160-08			16			60	6		5.27°	16.15	16.64	17.17	17.73	18.99
HFTNB 3020-200-08			20			60	6		4.47°	20.17	20.80	21.46	22.18	23.77
HFTNB 3020-220-08			22			70	6		4.16°	22.18	22.87	23.61	24.40	26.16
HFTNB 3020-260-08			26			70	6		3.65°	26.21	27.03	27.90	28.84	30.93
HFTNB 3020-300-08			30			70	6		3.25°	30.23	31.18	32.20	33.29	35.71
HFTNB 3020-320-08			32			80	6		3.08°	32.25	33.26	34.35	35.51	38.09
HFTNB 3020-400-08			40			80	6		2.55°	40.30	41.57	42.94	44.40	No Interference
HFTNB 3020-120-18		0.9°	12			60	6		6.52°	-	12.15	12.52	12.93	13.83
HFTNB 3020-160-18			16			60	6		5.38°	-	16.17	16.68	17.23	18.46
HFTNB 3020-200-18			20			60	6		4.57°	-	20.20	20.85	21.54	23.08
HFTNB 3020-260-18			26			70	6		3.74°	-	26.24	27.09	28.00	30.02
HFTNB 3020-300-18			30			70	6		3.33°	-	30.26	31.25	32.30	34.65
HFTNB 3020-360-18			36			80	6		2.86°	-	36.30	37.49	38.76	No Interference
HFTNB 3020-400-18			40			80	6		2.62°	-	40.33	41.65	43.06	No Interference
HFTNB 3020-500-18			50			100	6		2.16°	-	50.39	52.05	53.83	No Interference
HFTNB 3020-160-28		1.4°	16			60	6		5.49°	-	-	16.20	16.73	17.92
HFTNB 3020-200-28			20			60	6		4.68°	-	-	20.23	20.90	22.40
HFTNB 3020-260-28			26			70	6		3.83°	-	-	26.27	27.15	29.11
HFTNB 3020-300-28			30			70	6		3.41°	-	-	30.30	31.32	33.59
HFTNB 3020-400-28			40			80	6		2.69°	-	-	40.36	41.73	No Interference
HFTNB 3020-620-38		1.9°	62		-	100	6	B	-	-	-	-	No Interference	No Interference
HFTNB 3020-410-58		2.9°	41			80	6		-	-	-	-	-	No Interference
HFTNB 3030-200-08	R1.5	0.4°	20	2.4	16°	60	6	A	3.67°	20.23	20.84	21.49	22.19	23.75
HFTNB 3030-260-08			26			70	6		2.94°	26.27	27.07	27.93	28.86	No Interference
HFTNB 3030-300-08			30			70	6		2.60°	30.29	31.23	32.23	33.30	No Interference
HFTNB 3030-320-08			32			80	6		2.46°	32.31	33.31	34.38	35.52	No Interference
HFTNB 3030-400-08			40			80	6		2.01°	40.36	41.62	42.97	44.41	No Interference
HFTNB 3030-200-18		0.9°	20			60	6		3.76°	-	20.27	20.90	21.58	23.09
HFTNB 3030-300-18			30			70	6		2.67°	-	30.34	31.31	32.34	No Interference
HFTNB 3030-400-18			40			80	6		2.07°	-	40.40	41.71	43.11	No Interference
HFTNB 3030-500-18			50			100	6		1.69°	-	50.46	52.11	No Interference	No Interference
HFTNB 3030-600-18			60			100	6		1.43°	-	60.52	No Interference	No Interference	No Interference
HFTNB 3030-400-28		1.4°	40			80	6		2.12°	-	-	40.45	41.80	No Interference
HFTNB 3030-500-28			50			100	6		1.74°	-	-	50.51	No Interference	No Interference
HFTNB 3030-650-28			65		-	100	6	B	-	-	-	No Interference	No Interference	No Interference
HFTNB 3040-300-18	R2	0.9°	30	6	16°	80	6	A	1.90°	-	30.51	31.47	No Interference	No Interference
HFTNB 3040-400-18			40			80	6		1.45°	-	40.58	No Interference	No Interference	No Interference
HFTNB 3040-500-18			50			100	6		1.18°	-	50.64	No Interference	No Interference	No Interference
HFTNB 3040-600-18			60			100	6		0.99°	-	No Interference	No Interference	No Interference	No Interference
HFTNB 3040-480-28		1.4°	48		-	80	6	B	-	-	-	No Interference	No Interference	No Interference

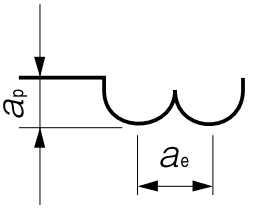
Milling Conditions for HFTNB

WORK MATERIAL			PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30~45HRC)				HARDENED STEELS SKD / SKT (45~55HRC)				HARDENED STEELS SKD / SKH (55~65HRC)			
Model Number	Radius of Ball Nose (mm)	Neck Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
3010-080-08	R0.5	8	14,000	1,200	0.09	0.18	13,750	1,160	0.06	0.1	13,500	1,120	0.04	0.06
3010-100-08		10	13,300	1,000	0.08	0.16	12,650	1,000	0.05	0.09	12,000	1,000	0.04	0.05
3010-120-08		12	13,000	870	0.07	0.14	12,000	850	0.04	0.08	11,000	880	0.03	0.05
3010-160-08		16	12,500	680	0.05	0.1	10,250	600	0.04	0.06	8,000	550	0.03	0.04
3010-200-08		20	12,000	600	0.04	0.08	9,500	500	0.03	0.06	7,000	400	0.02	0.04
3010-260-08		26	11,700	520	0.03	0.06	8,600	370	0.02	0.04	5,500	220	0.02	0.03
3010-300-08		30	11,500	500	0.02	0.05	8,250	350	0.02	0.04	5,000	200	0.02	0.03
3010-060-18		6	14,500	1,300	0.1	0.2	14,500	1,250	0.06	0.12	14,500	1,200	0.04	0.08
3010-080-18		8	14,000	1,200	0.09	0.18	13,750	1,160	0.06	0.1	13,500	1,120	0.04	0.06
3010-100-18		10	13,300	1,000	0.08	0.16	12,650	1,000	0.05	0.09	12,000	1,000	0.04	0.05
3010-120-18		12	13,000	870	0.07	0.14	12,000	850	0.04	0.08	11,000	880	0.03	0.05
3010-160-18		16	12,500	680	0.05	0.1	10,250	600	0.04	0.06	8,000	550	0.03	0.04
3010-200-18		20	12,000	600	0.04	0.08	9,500	500	0.03	0.06	7,000	400	0.02	0.04
3010-260-18		26	11,700	520	0.03	0.06	8,600	370	0.02	0.04	5,500	220	0.02	0.03
3010-300-18		30	11,500	500	0.02	0.05	8,250	350	0.02	0.04	5,000	200	0.02	0.03
3010-100-28		10	13,300	1,000	0.08	0.16	12,650	1,000	0.05	0.09	12,000	1,000	0.04	0.05
3010-120-28		12	13,000	870	0.07	0.14	12,000	850	0.04	0.08	11,000	880	0.03	0.05
3010-160-28		16	12,500	680	0.05	0.1	10,250	600	0.04	0.06	8,000	550	0.03	0.04
3010-200-28		20	12,000	600	0.04	0.08	9,500	500	0.03	0.06	7,000	400	0.02	0.04
3010-260-28		26	11,700	520	0.03	0.06	8,600	370	0.02	0.04	5,500	220	0.02	0.03
3015-100-08	R0.75	10	12,000	1,230	0.13	0.3	11,500	1,100	0.09	0.2	11,000	1,100	0.06	0.14
3015-160-08		16	11,200	930	0.1	0.25	10,600	910	0.07	0.16	10,000	900	0.05	0.11
3015-200-08		20	10,800	750	0.08	0.22	9,500	700	0.06	0.14	8,200	680	0.04	0.09
3015-300-08		30	10,000	550	0.06	0.16	8,300	450	0.04	0.1	6,600	380	0.03	0.08
3015-100-18		10	12,000	1,230	0.13	0.3	11,500	1,100	0.09	0.2	11,000	1,100	0.06	0.14
3015-160-18		16	11,200	930	0.1	0.25	10,600	910	0.07	0.16	10,000	900	0.05	0.11
3015-200-18		20	10,800	750	0.08	0.22	9,500	700	0.06	0.14	8,200	680	0.04	0.09
3015-300-18		30	10,000	550	0.06	0.16	8,300	450	0.04	0.1	6,600	380	0.03	0.08
3015-100-28		10	12,000	1,230	0.13	0.3	11,500	1,100	0.09	0.2	11,000	1,100	0.06	0.14
3015-160-28		16	11,200	930	0.1	0.25	10,600	910	0.07	0.16	10,000	900	0.05	0.11
3015-200-28		20	10,800	750	0.08	0.22	9,500	700	0.06	0.14	8,200	680	0.04	0.09
3015-300-28		30	10,000	550	0.06	0.16	8,300	450	0.04	0.1	6,600	380	0.03	0.08
3020-120-08	R1	12	10,300	1,200	0.16	0.38	10,150	1,130	0.12	0.25	10,000	1,100	0.1	0.18
3020-160-08		16	10,000	1,100	0.15	0.35	9,900	1,100	0.1	0.23	9,800	1,050	0.09	0.16
3020-200-08		20	9,500	950	0.15	0.32	9,300	940	0.1	0.21	9,000	930	0.08	0.15
3020-220-08		22	9,400	900	0.14	0.3	9,100	850	0.09	0.2	8,600	840	0.08	0.14
3020-260-08		26	9,300	750	0.12	0.28	8,700	730	0.08	0.2	8,000	700	0.07	0.13
3020-300-08		30	9,200	630	0.11	0.25	8,400	590	0.08	0.17	7,500	550	0.05	0.1
3020-320-08		32	8,800	580	0.1	0.24	8,200	550	0.07	0.16	7,300	480	0.04	0.1
3020-400-08		40	8,300	500	0.08	0.2	7,500	450	0.06	0.15	6,600	400	0.04	0.1
3020-120-18		12	10,300	1,200	0.16	0.38	10,150	1,130	0.12	0.25	10,000	1,100	0.1	0.18
3020-160-18		16	10,000	1,100	0.15	0.35	9,900	1,100	0.1	0.23	9,800	1,050	0.09	0.16
3020-200-18		20	9,500	950	0.15	0.32	9,300	940	0.1	0.21	9,000	930	0.08	0.15
3020-260-18		26	9,300	750	0.12	0.28	8,700	730	0.08	0.2	8,000	700	0.07	0.13
3020-300-18		30	9,200	630	0.11	0.25	8,400	590	0.08	0.17	7,500	550	0.05	0.1
3020-360-18		36	8,700	570	0.09	0.22	7,900	510	0.07	0.16	7,000	450	0.05	0.1
3020-400-18		40	8,300	500	0.08	0.2	7,500	450	0.06	0.15	6,600	400	0.04	0.1
3020-500-18		50	8,000	430	0.06	0.15	6,700	340	0.04	0.12	5,300	250	0.03	0.1
3020-160-28		16	10,000	1,100	0.15	0.35	9,900	1,100	0.1	0.23	9,800	1,050	0.09	0.16
3020-200-28		20	9,500	950	0.15	0.32	9,300	940	0.1	0.21	9,000	930	0.08	0.15
3020-260-28		26	9,300	750	0.12	0.28	8,700	730	0.08	0.2	8,000	700	0.07	0.13
3020-300-28		30	9,200	630	0.11	0.25	8,400	590	0.08	0.17	7,500	550	0.05	0.1
3020-400-28		40	8,300	500	0.08	0.2	7,500	450	0.06	0.15	6,600	400	0.04	0.1
3020-620-38		62	7,500	350	0.04	0.1	6,000	350	0.04	0.13	5,000	300	0.02	0.05
3020-410-58		41	8,300	500	0.08	0.2	7,500	450	0.06	0.15	6,600	400	0.04	0.1

Milling Conditions for HFTNB

WORK MATERIAL			PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30~ 45HRC)				HARDENED STEELS SKD / SKT (45~ 55HRC)				HARDENED STEELS SKD / SKH (55~ 65HRC)			
Model Number	Radius of Ball Nose (mm)	Neck Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
3030-200-08		20	9,000	1,150	0.25	0.48	8,900	1,100	0.18	0.36	8,800	1,100	0.12	0.25
3030-260-08		26	8,600	1,000	0.22	0.42	8,300	1,000	0.16	0.32	8,200	980	0.11	0.22
3030-300-08		30	8,400	950	0.21	0.4	8,100	930	0.15	0.3	7,800	920	0.1	0.21
3030-320-08		32	8,300	900	0.2	0.37	7,800	860	0.14	0.28	7,400	840	0.09	0.2
3030-400-08		40	8,000	720	0.17	0.33	7,000	630	0.12	0.24	6,000	550	0.08	0.19
3030-200-18		20	9,000	1,150	0.25	0.48	8,900	1,100	0.18	0.36	8,800	1,100	0.12	0.25
3030-300-18	**R1.5**	30	8,400	950	0.21	0.4	8,100	930	0.15	0.3	7,800	920	0.1	0.21
3030-400-18		40	8,000	720	0.17	0.33	7,000	630	0.12	0.24	6,000	550	0.08	0.19
3030-500-18		50	7,600	570	0.14	0.28	6,400	450	0.09	0.2	5,200	400	0.06	0.17
3030-600-18		60	7,200	480	0.12	0.24	6,000	400	0.07	0.18	4,700	320	0.05	0.16
3030-400-28		40	8,000	720	0.17	0.33	7,000	630	0.12	0.24	6,000	550	0.08	0.19
3030-500-28		50	7,600	570	0.14	0.28	6,400	450	0.09	0.2	5,200	400	0.06	0.17
3030-650-28		65	7,200	480	0.12	0.24	6,000	400	0.07	0.18	4,700	320	0.05	0.16
3040-300-18		30	8,000	1,100	0.35	0.55	7,800	1,050	0.24	0.4	7,600	1,000	0.16	0.33
3040-400-18		40	7,500	930	0.3	0.48	7,300	900	0.2	0.35	7,000	900	0.15	0.3
3040-500-18	**R2**	50	7,200	750	0.26	0.42	6,500	650	0.16	0.3	5,800	600	0.13	0.27
3040-600-18		60	7,000	600	0.22	0.36	6,000	520	0.13	0.26	5,000	440	0.11	0.25
3040-480-28		48	7,200	750	0.26	0.42	6,500	650	0.16	0.3	5,800	600	0.13	0.27

Note:
- ·Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
- ·Decrease the feed rate more than 50% from the milling parameters when slot milling.
- ·Every coolant offers stable milling.



a_p: Axial Depth(mm)
a_e: Radial Depth(mm)

Taper Pocket Milling Example
HFTNB R1 × Neck Length 30 × Neck Taper Angle 0.9°

NAK80（40HRC）

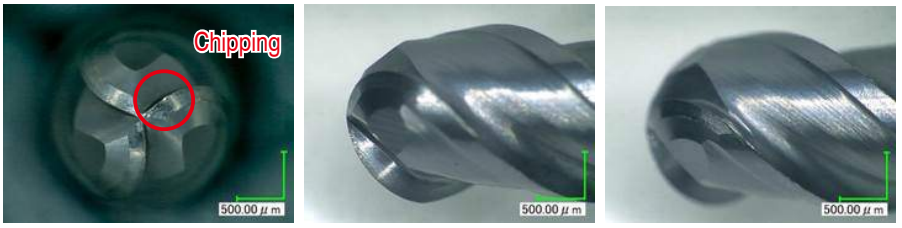
Milling Shape: Taper Pocket　30 x 5 x Depth 6 mm　Vertical Wall Inclined Angle 1°

After 102 min

HFTNB

No chipping after milling 3 pockets!

Competitor A

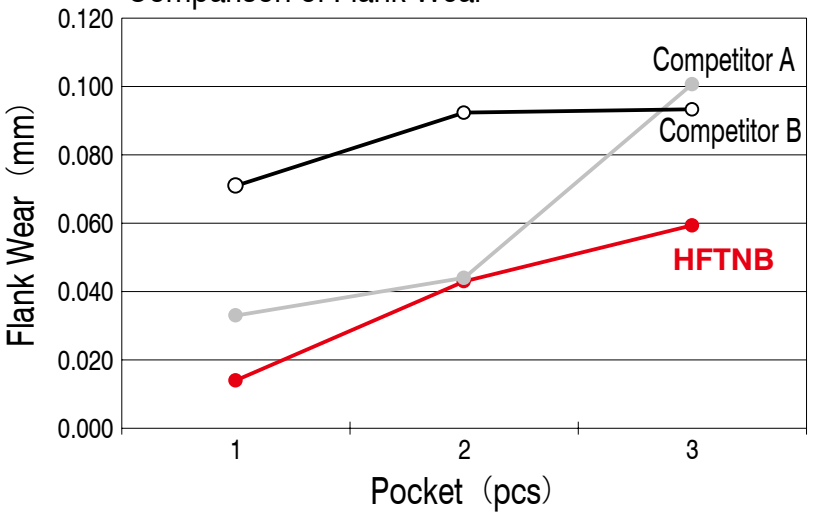


Chipping on a flute after milling 3 pockets.

Competitor B

Chipping on a flute after milling 1 pocket.

Comparison of Flank Wear



Flank Wear
（After milling 3 pockets）
Competitor A:　0.101 mm
Competitor B:　0.093 mm
HFTNB：0.059 mm

Better flank wear than competitors.

Tool	Spindle Speed（min^{-1}）	Feed Rate（mm/min）	Axial Depth a_p（mm）	Radial Depth a_e（mm）	Coolant	Cycle Time（min）
HFTNB 3020-300-18	9,200 min^{-1}	630 mm/min	0.11 mm	0.25 mm	Air Blow (Nozzle)	34 min / pocket（3 pockets total 102 min）

Size Ø0.1~Ø3

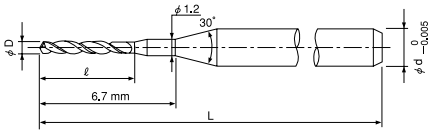
C-UMD

Super MG | MICRO COAT | 24° | Shank Dia 0/-0.005

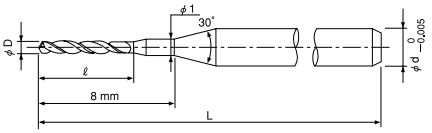
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material													
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	○	Contact sales when drilling over 45HRC.			○	◎		○			○	○		

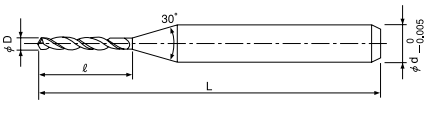
■ φ 0.1 ~ φ 0.25



■ φ 0.26 ~ φ 0.65



■ φ 0.66 ~ φ 3



Actual tool geometries for some specifications and tolerances may differ from above drawings.

Diameter Tolerance : Ø D ≤ Ø 3 : Ø D $^{0}_{-0.01}$

Point Angle : 150°

Total 225 models Unit (mm)

Model Number	Diameter ØD	Flute Length ℓ	Overall Length L	Shank Diameter Ød
C-UMD 2010-012	0.1	1.2	38	3
C-UMD 2011-012	0.11	1.2	38	3
C-UMD 2012-014	0.12	1.4	38	3
C-UMD 2013-014	0.13	1.4	38	3
C-UMD 2014-014	0.14	1.4	38	3
C-UMD 2015-020	0.15	2	38	3
C-UMD 2016-020	0.16	2	38	3
C-UMD 2017-020	0.17	2	38	3
C-UMD 2018-020	0.18	2	38	3
C-UMD 2019-020	0.19	2	38	3
C-UMD 2020-025	0.2	2.5	38	3
C-UMD 2021-025	0.21	2.5	38	3
C-UMD 2022-025	0.22	2.5	38	3
C-UMD 2023-025	0.23	2.5	38	3
C-UMD 2024-025	0.24	2.5	38	3
C-UMD 2025-030	0.25	3	38	3
C-UMD 2026-030	0.26	3	38	3
C-UMD 2027-030	0.27	3	38	3
C-UMD 2028-030	0.28	3	38	3
C-UMD 2029-030	0.29	3	38	3
C-UMD 2030-050	0.3	5	38	3
C-UMD 2031-050	0.31	5	38	3
C-UMD 2032-050	0.32	5	38	3
C-UMD 2033-050	0.33	5	38	3

Unit (mm)

Model Number	Diameter ØD	Flute Length ℓ	Overall Length L	Shank Diameter Ød
C-UMD 2034-050	0.34	5	38	3
C-UMD 2035-060	0.35	6	38	3
C-UMD 2036-060	0.36	6	38	3
C-UMD 2037-060	0.37	6	38	3
C-UMD 2038-060	0.38	6	38	3
C-UMD 2039-060	0.39	6	38	3
C-UMD 2040-070	0.4	7	38	3
C-UMD 2041-070	0.41	7	38	3
C-UMD 2042-070	0.42	7	38	3
C-UMD 2043-070	0.43	7	38	3
C-UMD 2044-070	0.44	7	38	3
C-UMD 2045-070	0.45	7	38	3
C-UMD 2046-070	0.46	7	38	3
C-UMD 2047-070	0.47	7	38	3
C-UMD 2048-070	0.48	7	38	3
C-UMD 2049-070	0.49	7	38	3
C-UMD 2050-070	0.5	7	38	3
C-UMD 2051-070	0.51	7	38	3
C-UMD 2052-070	0.52	7	38	3
C-UMD 2053-070	0.53	7	38	3
C-UMD 2054-070	0.54	7	38	3
C-UMD 2055-070	0.55	7	38	3
C-UMD 2056-070	0.56	7	38	3
C-UMD 2057-070	0.57	7	38	3

Next Page ➡

Unit（mm）

Model Number	Diameter ØD	Flute Length ℓ	Overall Length L	Shank Diameter Ød
C-UMD 2058-070	0.58	7	38	3
C-UMD 2059-070	0.59	7	38	3
C-UMD 2060-070	0.6	7	38	3
C-UMD 2061-070	0.61	7	38	3
C-UMD 2062-070	0.62	7	38	3
C-UMD 2063-070	0.63	7	38	3
C-UMD 2064-070	0.64	7	38	3
C-UMD 2065-070	0.65	7	38	3
C-UMD 2066-070	0.66	7	38	3
C-UMD 2067-070	0.67	7	38	3
C-UMD 2068-070	0.68	7	38	3
C-UMD 2069-070	0.69	7	38	3
C-UMD 2070-080	0.7	8	38	3
C-UMD 2071-080	0.71	8	38	3
C-UMD 2072-080	0.72	8	38	3
C-UMD 2073-080	0.73	8	38	3
C-UMD 2074-080	0.74	8	38	3
C-UMD 2075-080	0.75	8	38	3
C-UMD 2076-080	0.76	8	38	3
C-UMD 2077-080	0.77	8	38	3
C-UMD 2078-080	0.78	8	38	3
C-UMD 2079-080	0.79	8	38	3
C-UMD 2080-100	0.8	10	38	3
C-UMD 2081-100	0.81	10	38	3
C-UMD 2082-100	0.82	10	38	3
C-UMD 2083-100	0.83	10	38	3
C-UMD 2084-100	0.84	10	38	3
C-UMD 2085-100	0.85	10	38	3
C-UMD 2086-100	0.86	10	38	3
C-UMD 2087-100	0.87	10	38	3
C-UMD 2088-100	0.88	10	38	3
C-UMD 2089-100	0.89	10	38	3
C-UMD 2090-100	0.9	10	38	3
C-UMD 2091-100	0.91	10	38	3
C-UMD 2092-100	0.92	10	38	3
C-UMD 2093-100	0.93	10	38	3
C-UMD 2094-100	0.94	10	38	3
C-UMD 2095-100	0.95	10	38	3
C-UMD 2096-100	0.96	10	38	3
C-UMD 2097-100	0.97	10	38	3
C-UMD 2098-100	0.98	10	38	3
C-UMD 2099-100	0.99	10	38	3
C-UMD 2100-100	1	10	38	3
C-UMD 2101-100	1.01	10	38	3
C-UMD 2102-100	1.02	10	38	3
C-UMD 2103-100	1.03	10	38	3

Unit（mm）

Model Number	Diameter ØD	Flute Length ℓ	Overall Length L	Shank Diameter Ød
C-UMD 2104-100	1.04	10	38	3
C-UMD 2105-100	1.05	10	38	3
C-UMD 2106-100	1.06	10	38	3
C-UMD 2107-100	1.07	10	38	3
C-UMD 2108-100	1.08	10	38	3
C-UMD 2109-100	1.09	10	38	3
C-UMD 2110-100	1.1	10	38	3
C-UMD 2111-100	1.11	10	38	3
C-UMD 2112-100	1.12	10	38	3
C-UMD 2113-100	1.13	10	38	3
C-UMD 2114-100	1.14	10	38	3
C-UMD 2115-100	1.15	10	38	3
C-UMD 2116-100	1.16	10	38	3
C-UMD 2117-100	1.17	10	38	3
C-UMD 2118-100	1.18	10	38	3
C-UMD 2119-100	1.19	10	38	3
C-UMD 2120-100	1.2	10	38	3
C-UMD 2121-100	1.21	10	38	3
C-UMD 2122-100	1.22	10	38	3
C-UMD 2123-100	1.23	10	38	3
C-UMD 2124-100	1.24	10	38	3
C-UMD 2125-100	1.25	10	38	3
C-UMD 2126-100	1.26	10	38	3
C-UMD 2127-100	1.27	10	38	3
C-UMD 2128-100	1.28	10	38	3
C-UMD 2129-100	1.29	10	38	3
C-UMD 2130-100	1.3	10	38	3
C-UMD 2131-100	1.31	10	38	3
C-UMD 2132-100	1.32	10	38	3
C-UMD 2133-100	1.33	10	38	3
C-UMD 2134-100	1.34	10	38	3
C-UMD 2135-100	1.35	10	38	3
C-UMD 2136-100	1.36	10	38	3
C-UMD 2137-100	1.37	10	38	3
C-UMD 2138-100	1.38	10	38	3
C-UMD 2139-100	1.39	10	38	3
C-UMD 2140-100	1.4	10	38	3
C-UMD 2141-100	1.41	10	38	3
C-UMD 2142-100	1.42	10	38	3
C-UMD 2143-100	1.43	10	38	3
C-UMD 2144-100	1.44	10	38	3
C-UMD 2145-100	1.45	10	38	3
C-UMD 2146-100	1.46	10	38	3
C-UMD 2147-100	1.47	10	38	3
C-UMD 2148-100	1.48	10	38	3
C-UMD 2149-100	1.49	10	38	3

Next Page➡

2 Flutes UNIMAX DRILL

Unit（mm）

Model Number	Diameter ØD	Flute Length ℓ	Overall Length L	Shank Diameter Ød
C-UMD 2150-100	1.5	10	38	3
C-UMD 2151-100	1.51	10	38	3
C-UMD 2152-100	1.52	10	38	3
C-UMD 2153-100	1.53	10	38	3
C-UMD 2154-100	1.54	10	38	3
C-UMD 2155-100	1.55	10	38	3
C-UMD 2156-100	1.56	10	38	3
C-UMD 2157-100	1.57	10	38	3
C-UMD 2158-100	1.58	10	38	3
C-UMD 2159-100	1.59	10	38	3
C-UMD 2160-120	1.6	12	38	3
C-UMD 2161-120	1.61	12	38	3
C-UMD 2162-120	1.62	12	38	3
C-UMD 2163-120	1.63	12	38	3
C-UMD 2164-120	1.64	12	38	3
C-UMD 2165-120	1.65	12	38	3
C-UMD 2166-120	1.66	12	38	3
C-UMD 2167-120	1.67	12	38	3
C-UMD 2168-120	1.68	12	38	3
C-UMD 2169-120	1.69	12	38	3
C-UMD 2170-120	1.7	12	38	3
C-UMD 2171-120	1.71	12	38	3
C-UMD 2172-120	1.72	12	38	3
C-UMD 2173-120	1.73	12	38	3
C-UMD 2174-120	1.74	12	38	3
C-UMD 2175-120	1.75	12	38	3
C-UMD 2176-120	1.76	12	38	3
C-UMD 2177-120	1.77	12	38	3
C-UMD 2178-120	1.78	12	38	3
C-UMD 2179-120	1.79	12	38	3
C-UMD 2180-120	1.8	12	38	3
C-UMD 2181-120	1.81	12	38	3
C-UMD 2182-120	1.82	12	38	3
C-UMD 2183-120	1.83	12	38	3
C-UMD 2184-120	1.84	12	38	3
C-UMD 2185-120	1.85	12	38	3
C-UMD 2186-120	1.86	12	38	3
C-UMD 2187-120	1.87	12	38	3
C-UMD 2188-120	1.88	12	38	3
C-UMD 2189-120	1.89	12	38	3
C-UMD 2190-120	1.9	12	38	3
C-UMD 2191-120	1.91	12	38	3
C-UMD 2192-120	1.92	12	38	3

Unit（mm）

Model Number	Diameter ØD	Flute Length ℓ	Overall Length L	Shank Diameter Ød
C-UMD 2193-120	1.93	12	38	3
C-UMD 2194-120	1.94	12	38	3
C-UMD 2195-120	1.95	12	38	3
C-UMD 2196-120	1.96	12	38	3
C-UMD 2197-120	1.97	12	38	3
C-UMD 2198-120	1.98	12	38	3
C-UMD 2199-120	1.99	12	38	3
C-UMD 2200-120	2	12	38	3
C-UMD 2205-120	2.05	12	38	3
C-UMD 2210-120	2.1	12	38	3
C-UMD 2212-120	2.12	12	38	3
C-UMD 2213-120	2.13	12	38	3
C-UMD 2214-120	2.14	12	38	3
C-UMD 2215-120	2.15	12	38	3
C-UMD 2220-120	2.2	12	38	3
C-UMD 2225-120	2.25	12	38	3
C-UMD 2229-120	2.29	12	38	3
C-UMD 2230-120	2.3	12	38	3
C-UMD 2231-120	2.31	12	38	3
C-UMD 2232-120	2.32	12	38	3
C-UMD 2235-120	2.35	12	38	3
C-UMD 2239-120	2.39	12	38	3
C-UMD 2240-120	2.4	12	38	3
C-UMD 2241-120	2.41	12	38	3
C-UMD 2242-120	2.42	12	38	3
C-UMD 2245-120	2.45	12	38	3
C-UMD 2250-120	2.5	12	38	3
C-UMD 2255-120	2.55	12	38	3
C-UMD 2256-120	2.56	12	38	3
C-UMD 2257-120	2.57	12	38	3
C-UMD 2260-120	2.6	12	38	3
C-UMD 2265-120	2.65	12	38	3
C-UMD 2270-120	2.7	12	38	3
C-UMD 2275-120	2.75	12	38	3
C-UMD 2277-120	2.77	12	38	3
C-UMD 2278-120	2.78	12	38	3
C-UMD 2279-120	2.79	12	38	3
C-UMD 2280-120	2.8	12	38	3
C-UMD 2285-120	2.85	12	38	3
C-UMD 2290-120	2.9	12	38	3
C-UMD 2295-120	2.95	12	38	3
C-UMD 2300-120	3	12	38	3

Milling Conditions for C-UMD

WORK MATERIAL	CARBON STEELS S45C / S50C (～225HB)		ALLOY STEELS SK / SCM / SUS (225～325HB)		PREHARDENED STEELS HARDENED STEELS NAK / SKD (30～45HRC)		ALUMINUM ALLOYS A5052	
Velocity	*Vc*=25～40 m/min		*Vc*=15～25 m/min		*Vc*=10～15 m/min		*Vc*=20～60 m/min	
Diameter (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)
0.3	20,000	40	15,900	30	10,600	10	20,000	400
0.4	17,400	50	11,800	40	8,000	20	19,900	690
0.5	15,900	80	9,500	50	6,400	30	20,000	1,000
0.6	14,100	80	7,900	40	5,300	20	19,900	1,050
0.7	12,800	90	6,800	50	4,500	20	19,900	1,120
0.8	11,900	100	6,000	50	4,000	20	19,900	1,190
0.9	10,500	100	6,200	50	3,500	20	17,600	1,220
1	9,500	100	6,400	60	3,200	20	15,900	1,270
2	5,600	170	3,200	100	1,600	20	9,500	950
3	3,700	150	2,700	110	1,600	20	6,400	640

Note:
・Recommend step amount 0.1D-0.2D. Recommend 0.2D-0.5D for Aluminum Alloys.
・Recommend water soluble or oil coolant.
・Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.

Drilling Example 1

Comments

● Tip Damage:

Damage by chipping can be seen on the Carbide Drill. The High-Speed Steel Drill exhibits wear on the top chisel line and corners. The High Speed drill also has the work material adhering to it.

● Hole Position:

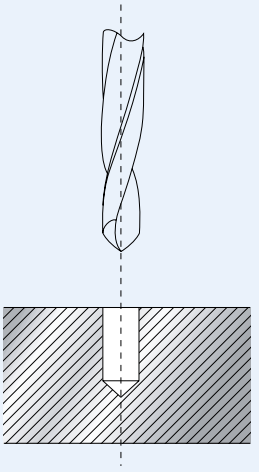
The solid carbide drill has minimal deflection when compared to a High Speed steel model, through the entire drilling cycle.

Drilling Condition

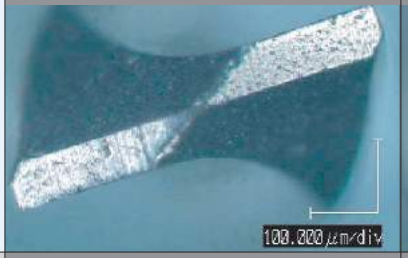
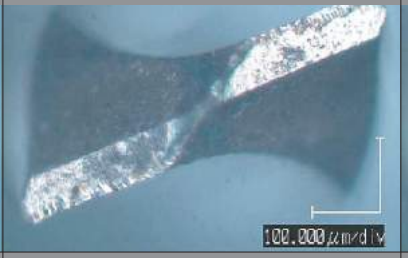
Tool:	ϕ 0.6 × Flute Length 7mm
Work Material:	SUS304（1.4301）
Spindle Speed:	8,000 min^{-1}
Velocity:	15 m/min
Z Feed Rate:	50 mm/min
Chip Load:	0.00625 mm/rev
Peck Amount:	0.12 mm/time
Hole Depth:	2.4 mm
Number of Holes:	500 holes
Drilling Time:	25 min/100 holes
Overhang Length:	10 mm
Coolant:	Water Soluble (Nozzle)

Process Form

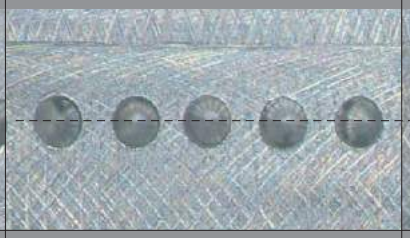
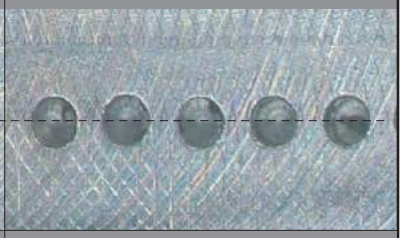
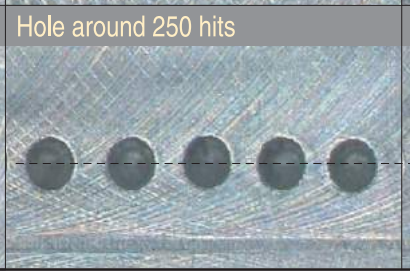
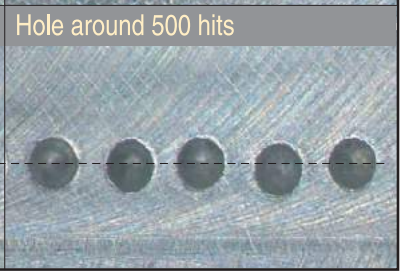
* Blind Hole Step Process



Comparison of Tip Damage

	New Tool	After 250 hits	After 500 hits
UT C-UMD2060-070 Ø0.6 Flute Length 7 mm Ti-Composite Membrane			
Company A High Speed Steel Drill Ø0.6 Flute Length 7 mm TiN			

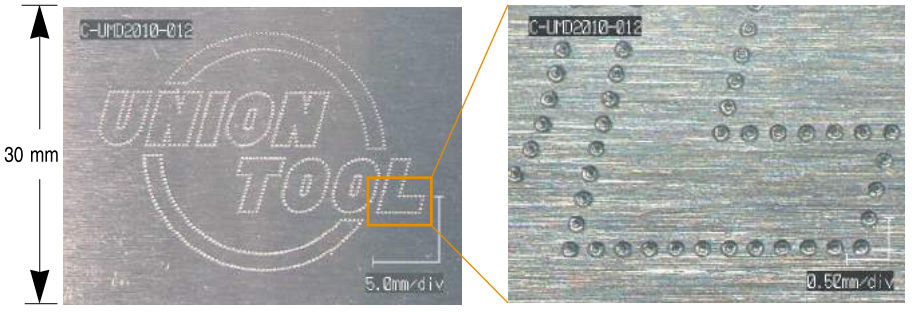
Comparison of Hole Position

	Hole around 1 hit	Hole around 250 hits	Hole around 500 hits
Ø0.6 Flute Length 7 mm Ti-Composite Membrane			
Company A High Speed Steel Drill			

Drilling Example 2

Drilling Condition

Tool: ϕ 0.1
Work Material: SUS304 (1.4301)
Number of Holes: 800 holes



	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Peck Amount (mm/time)	Hole Depth (mm)	Drilling Time	Coolant	Note
Acrylic ϕ0.1							
C-UMD ϕ 0.1	20,000	20	0.02	1.00	1 h 30 min	Air Blow	Direct + Drilling
SUS304 (1.4301) ϕ0.1							
Center Drill+Chamfering C-UMD ϕ 0.2	10,000	2	0.01	0.05	2 h 50 min	Water Soluble	
Drilling C-UMD ϕ 0.1	12,000	4	0.02	0.20	3 h 27 min	Water Soluble	
Aluminum (A5052) ϕ0.2							
C-UMD ϕ 0.2	16,000	80	0.04	1.50	2 h 50 min	Water Soluble	Using back-up board
NAK55 (AISI P21) ϕ0.3							
C-UMD ϕ 0.3	15,000	15	0.06	1.50	3 h 35 min	Water Soluble	Using Center Drill
SUS304 (1.4301) ϕ0.3							
C-UMD ϕ 0.3	16,000	30	0.06	1.50	2 h 24 min	Water Soluble	Using Center Drill

2 Flutes UNIMAX DRILL

Size Ø2~Ø12

UTDF

Super MG | UT COAT | 30° | Flatland | Shank Dia 0/-0.005

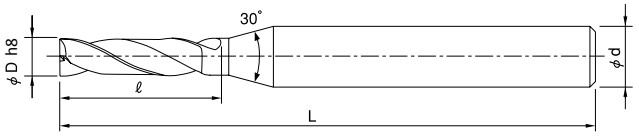
Additional 8 models

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material															
STRUCTUAL STEELS SS400	Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	○				◎	◎								

Features

Available to a wide variety of applications by the 180˚ point angle.
The helix angle of 30˚ offers excellent chip evacuation, stable and highly efficient pilot hole drilling.
New web-thinning design for improved chip evacuation and sharpness.
Double-margin will guide the tool into inner wall and achieve high-straightness drilling to non-planar surface.
Size M4 - M12 for drilling pilot holes before tapping.

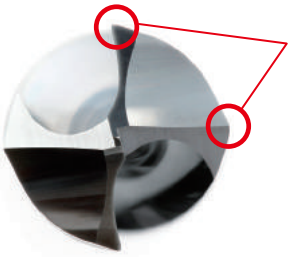


Outside Diameter	Diameter Tolerance (h8)
ØD ≤ 3	0/-0.014
3 <Ø D ≤ 6	0/-0.018
6 <Ø D ≤ 10	0/-0.022
10 <Ø D ≤ 12	0/-0.027

Feature1 : Helix angle 30˚

Excellent chip evacuation with 30˚ helix angle

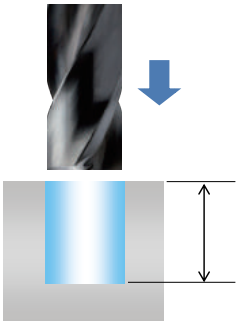
Feature2 : Double-margin



Double-margin

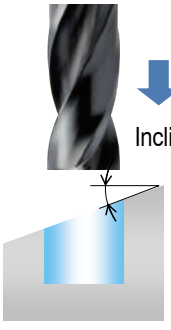
High-straightness drilling

Feature3 : A wide variety of applications



Hole depth : 2D or smaller (ℓD=4)
1D or smaller (ℓD=2)

Flat surface



Inclined angle θ

Inclined surface

Designed for drilling on flat, inclined or curved surfaces.

Total 21 models

Unit（mm）

Model Number	Outside Diameter ØD	Flute Length ℓ	Overall Length L	Shank Diameter Ød
UTDF 2200-080	2	8	50	4
※ UTDF 2250-100	2.5	10	50	4
UTDF 2300-120	3	12	60	6
UTDF 2330-132	3.3	13.2	60	6
UTDF 2400-160	4	16	60	6
UTDF 2420-168	4.2	16.8	60	6
UTDF 2500-200	5	20	60	6
※ UTDF 2510-204	5.1	20.4	60	6
UTDF 2600-240	6	24	60	6
※ UTDF 2650-130	6.5	13	70	8
UTDF 2680-272	6.8	27.2	70	8
※ UTDF 2700-280	7	28	80	8
UTDF 2800-320	8	32	80	8
UTDF 2850-340	8.5	34	80	10
※ UTDF 2860-344	8.6	34.4	80	10
※ UTDF 2900-360	9	36	80	10
※ UTDF 2950-190	9.5	19	90	10
UTDF 21000-400	10	40	90	10
UTDF 21030-412	10.3	41.2	90	12
※ UTDF 21100-220	11	22	100	12
UTDF 21200-480	12	48	100	12

※ Additional model

*Contact our sales for the custom size tool.

Milling Conditions for UTDF

Flat Surface

WORK MATERIAL			CARBON STEELS STRUCTUAL STEELS GRAY IRON S50C / SS400 / FC250		ALLOY STEELS SCM415		PREHARDENED STEELS NAK80		DUCTILE IRON FCD		ALUMINUM ALLOYS A5052 / A7075		ALUMINUM CAST ADC12	
Model Number	Outside Diameter (mm)	Flute Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)
2200-080	**2**	8	15,000	900	12,900	740	6,000	160	12,900	660	25,200	2,070	18,900	1,340
2250-100	**2.5**	10	12,000	880	10,320	730	4,800	160	10,320	660	20,160	2,070	15,120	1,340
2300-120	**3**	12	10,000	860	8,600	710	4,000	150	8,600	630	16,800	1,970	12,600	1,280
2330-132	**3.3**	13.2	9,090	860	7,820	710	3,640	150	7,820	630	15,280	1,970	11,460	1,280
2400-160	**4**	16	7,500	830	6,450	690	3,000	150	6,450	610	12,600	1,900	9,450	1,230
2420-168	**4.2**	16.8	7,150	830	6,150	690	2,860	150	6,150	610	12,000	1,900	9,000	1,230
2500-200	**5**	20	6,000	800	5,160	660	2,400	140	5,160	590	10,080	1,840	7,560	1,190
2510-204	**5.1**	20.4	5,880	800	5,060	660	2,350	140	5,060	590	9,880	1,840	7,400	1,190
2600-240	**6**	24	5,000	770	4,300	640	2,000	140	4,300	560	8,400	1,770	6,300	1,140
2650-130	**6.5**	13	4,620	770	3,970	640	1,850	140	3,970	560	7,750	1,770	5,820	1,140
2680-272	**6.8**	27.2	4,420	770	3,800	640	1,770	140	3,800	560	7,420	1,770	5,560	1,140
2700-280	**7**	28	4,290	760	3,680	630	1,710	140	3,680	560	7,200	1,770	5,400	1,140
2800-320	**8**	32	3,750	730	3,230	600	1,500	130	3,230	540	6,300	1,670	4,730	1,080
2850-340	**8.5**	34	3,530	730	3,040	600	1,420	130	3,040	540	5,930	1,670	4,450	1,080
2860-344	**8.6**	34.4	3,490	720	3,000	600	1,400	130	3,000	540	5,860	1,670	4,400	1,080
2900-360	**9**	36	3,330	720	2,870	590	1,330	120	2,870	530	5,600	1,670	4,200	1,080
2950-190	**9.5**	19	3,160	700	2,720	580	1,260	120	2,720	520	5,300	1,620	3,980	1,050
21000-400	**10**	40	3,000	690	2,580	570	1,200	120	2,580	510	5,040	1,580	3,780	1,020
21030-412	**10.3**	41.2	2,920	690	2,510	570	1,170	120	2,510	510	4,900	1,580	3,670	1,020
21100-220	**11**	22	2,730	670	2,350	550	1,090	110	2,350	500	4,580	1,540	3,440	1,000
21200-480	**12**	48	2,500	650	2,150	540	1,000	110	2,150	480	4,200	1,490	3,150	960

Milling Conditions for UTDF

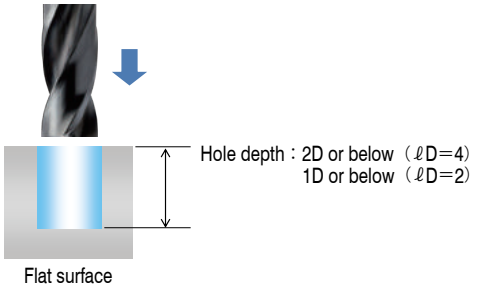
Inclined Surface（$\theta \leq 30°$）

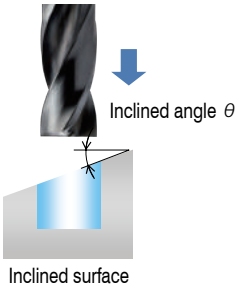
WORK MATERIAL			CARBON STEELS STRUCTUAL STEELS GRAY IRON S50C / SS400 / FC250		ALLOY STEELS SCM415		PREHARDENED STEELS NAK80		DUCTILE IRON FCD		ALUMINUM ALLOYS A5052 / A7075		ALUMINUM CAST ADC12	
Model Number	Outside Diameter (mm)	Flute Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)
2200-080	**2**	8	15,000	270	12,900	220	6,000	48	12,900	190	25,200	620	18,900	400
2250-100	**2.5**	10	12,000	260	10,320	220	4,800	48	10,320	190	20,160	620	15,120	400
2300-120	**3**	12	10,000	250	8,600	210	4,000	45	8,600	180	16,800	590	12,600	380
2330-132	**3.3**	13.2	9,090	250	7,820	210	3,640	45	7,820	180	15,280	590	11,460	380
2400-160	**4**	16	7,500	240	6,450	200	3,000	45	6,450	180	12,600	570	9,450	360
2420-168	**4.2**	16.8	7,150	240	6,150	200	2,860	45	6,150	180	12,000	570	9,000	360
2500-200	**5**	20	6,000	240	5,160	190	2,400	42	5,160	170	10,080	550	7,560	350
2510-204	**5.1**	20.4	5,880	230	5,060	190	2,350	42	5,060	170	9,880	550	7,400	350
2600-240	**6**	24	5,000	230	4,300	190	2,000	42	4,300	160	8,400	530	6,300	340
2650-130	**6.5**	13	4,620	230	3,970	190	1,850	42	3,970	160	7,750	530	5,820	340
2680-272	**6.8**	27.2	4,420	230	3,800	190	1,770	42	3,800	160	7,420	530	5,560	340
2700-280	**7**	28	4,290	230	3,680	190	1,710	42	3,680	160	7,200	530	5,400	340
2800-320	**8**	32	3,750	210	3,230	180	1,500	39	3,230	160	6,300	500	4,730	320
2850-340	**8.5**	34	3,530	210	3,040	180	1,420	39	3,040	160	5,930	500	4,450	320
2860-344	**8.6**	34.4	3,490	210	3,000	180	1,400	39	3,000	160	5,860	500	4,400	320
2900-360	**9**	36	3,330	210	2,870	180	1,330	38	2,870	160	5,600	500	4,200	320
2950-190	**9.5**	19	3,160	210	2,720	170	1,260	36	2,720	150	5,300	490	3,980	310
21000-400	**10**	40	3,000	200	2,580	170	1,200	36	2,580	150	5,040	470	3,780	300
21030-412	**10.3**	41.2	2,920	200	2,510	170	1,170	36	2,510	150	4,900	470	3,670	300
21100-220	**11**	22	2,730	200	2,350	160	1,090	34	2,350	140	4,580	460	3,440	290
21200-480	**12**	48	2,500	190	2,150	160	1,000	33	2,150	140	4,200	440	3,150	280

Milling Conditions for UTDF

Inclined Surface（$\theta > 30°$）

WORK MATERIAL			CARBON STEELS STRUCTUAL STEELS GRAY IRON S50C / SS400 / FC250		ALLOY STEELS SCM415		PREHARDENED STEELS NAK80		DUCTILE IRON FCD		ALUMINUM ALLOYS A5052 / A7075		ALUMINUM CAST ADC12	
Model Number	Outside Diameter (mm)	Flute Length (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)
2200-080	**2**	8	10,500	90	9,030	74	4,200	16	9,030	66	17,640	200	13,230	130
2250-100	**2.5**	10	8,400	90	7,220	74	3,360	16	7,220	66	14,110	200	10,580	130
2300-120	**3**	12	7,000	86	6,020	71	2,800	15	6,020	63	11,760	190	8,820	120
2330-132	**3.3**	13.2	6,370	86	5,480	71	2,550	15	5,480	63	10,700	190	8,030	120
2400-160	**4**	16	5,250	83	4,520	69	2,100	15	4,520	61	8,820	190	6,620	120
2420-168	**4.2**	16.8	5,010	83	4,310	69	2,010	15	4,310	61	8,400	190	6,300	120
2500-200	**5**	20	4,200	80	3,620	66	1,680	14	3,620	59	7,060	180	5,300	110
2510-204	**5.1**	20.4	4,120	80	3,540	66	1,650	14	3,540	59	6,920	180	5,190	110
2600-240	**6**	24	3,500	77	3,010	64	1,400	14	3,010	56	5,880	170	4,410	110
2650-130	**6.5**	13	3,230	77	2,780	64	1,290	14	2,780	56	5,430	170	4,070	110
2680-272	**6.8**	27.2	3,100	77	2,660	64	1,240	14	2,660	56	5,200	170	3,900	110
2700-280	**7**	28	3,000	77	2,580	64	1,200	14	2,580	56	5,040	170	3,780	110
2800-320	**8**	32	2,630	73	2,270	60	1,050	13	2,270	54	4,410	160	3,320	100
2850-340	**8.5**	34	2,480	73	2,130	60	1,000	13	2,130	54	4,160	160	3,120	100
2860-344	**8.6**	34.4	2,440	73	2,100	60	980	13	2,100	54	4,100	160	3,080	100
2900-360	**9**	36	2,330	73	2,010	60	930	13	2,010	54	3,920	160	2,940	100
2950-190	**9.5**	19	2,210	71	1,900	58	880	12	1,900	53	3,710	150	2,790	100
21000-400	**10**	40	2,100	69	1,810	57	840	12	1,810	51	3,530	150	2,650	100
21030-412	**10.3**	41.2	2,050	69	1,760	57	820	12	1,760	51	3,430	150	2,570	100
21100-220	**11**	22	1,910	67	1,640	55	760	11	1,640	49	3,210	140	2,400	90
21200-480	**12**	48	1,750	65	1,510	54	700	11	1,510	48	2,940	140	2,210	90



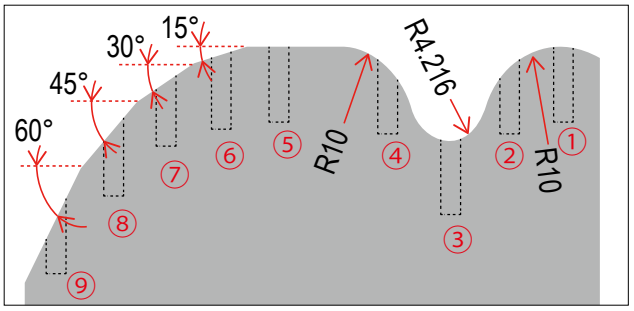


Note:
- These milling parameters are for reference only.
- Adjust the parameters in accordance with the machine rigidity, workpiece clamping condition and shape.
- Recommend water soluble or oil coolant.
- Step milling is recommended in case of clogging.

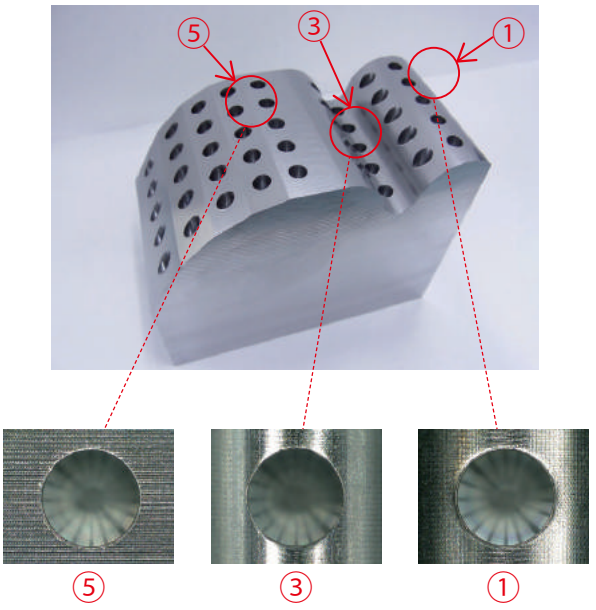
UTDF Inclined Surface Milling Conditions
Ø3.5 × Flute Length 14 mm (Prototype)

SS400

Work Shape



Coolant : Water Soluble (Nozzle)
Work Size : 40 × 75 × 60 mm



Each hole after drilling

Drilling spot	Surface	Spindle Speed (min^{-1})	Feed Rate (min/min)	Drilling Depth (The Deepest spot) (mm)
1	凸 Curved surface (Top)	7,000	450	7
2	Curved surface (45°)		270	
3	凹 Curved surface (Top)		450	
4	Curved surface (45°)		270	
5	Flat Surface		450	
6	Inclined Surface (15°)		320	
7	Inclined Surface (30°)		320	
8	Inclined Surface (45°)		270	
9	Inclined Surface (60°)		225	

*Contact our sales for the custom size tool.

Excellent drilling performance with less burrs.

UTDF Inclined Surface Milling Video

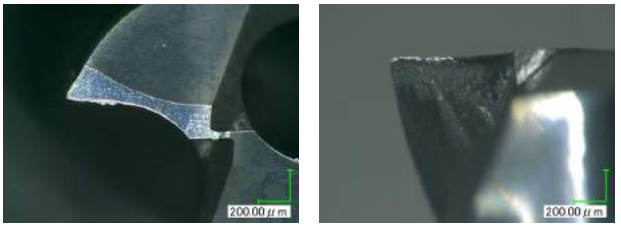
Tool After Drilling Ø 2 × Flute Length 8 mm

A5052

Surface	Spindle Speed	Feed Rate	Drilling Depth	Number of Holes	Coolant
Flat Surface	23,100 min^{-1}	830 mm/min	4 mm	100 holes	Water Soluble (Nozzle)

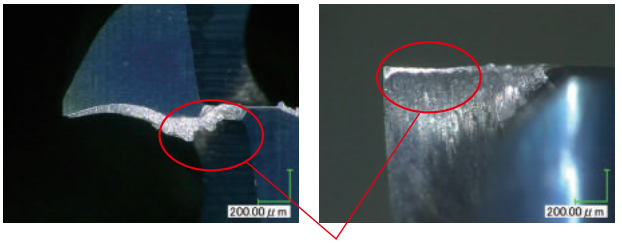
Comparison of Tip Damage after 100 hits

UTDF



More tool-life left without adhesion after drilling 100 holes.

Competitor



Chip adhesion

2 Flutes UNIMAX DRILL Long Flute

Size Ø0.3~Ø3

UTDLX

Super MG | MICRO COAT | 30° | X Thinning | Shank Dia 0/-0.005

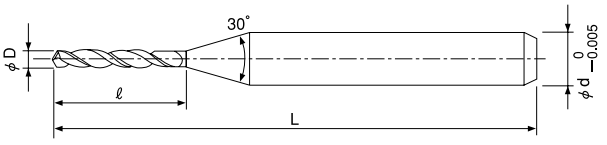
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
STRUCTUAL STEELS SS400	Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	○	Contact sales when drilling over 45HRC.			○	◎					○	○		

Features

A highly efficient and economic drill for both mass and prototype production of parts.
UT MICRO COAT offers excellent performance for cutting a broad range of materials.
The new drill design and geometry offers stable drilling performance with increased tool life.
The 130° point angle ensures reduced burring of the drilled hole.
With an aspect ratio of 15:1, the drill is ideal for deep hole drilling, that requires high accuracy.

Diameter Tolerance: ØD0/-0.01 mm
Point Angle: 130°



Total 55 models **Unit (mm)**

Model Number	Outside Diameter ØD	Flute Length ℓ	Overall Length L	Shank Diameter Ød
UTDLX 2030-045	0.3	4.5	38	3
UTDLX 2035-053	0.35	5.3	38	3
UTDLX 2040-060	0.4	6	38	3
UTDLX 2045-068	0.45	6.8	38	3
UTDLX 2050-075	0.5	7.5	38	3
UTDLX 2055-083	0.55	8.3	38	3
UTDLX 2060-090	0.6	9	45	3
UTDLX 2065-098	0.65	9.8	45	3
UTDLX 2070-105	0.7	10.5	45	3
UTDLX 2075-113	0.75	11.3	45	3
UTDLX 2080-120	0.8	12	45	3
UTDLX 2085-128	0.85	12.8	45	3

Next Page ➡

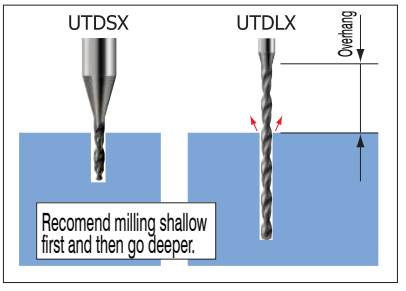
Unit（mm）

Model Number	Outside Diameter ØD	Flute Length ℓ	Overall Length L	Shank Diameter Ød
UTDLX 2090-135	0.9	13.5	45	3
UTDLX 2095-143	0.95	14.3	45	3
UTDLX 2100-150	1	15	50	3
UTDLX 2105-158	1.05	15.8	50	3
UTDLX 2110-165	1.1	16.5	50	3
UTDLX 2115-173	1.15	17.3	50	3
UTDLX 2120-180	1.2	18	50	3
UTDLX 2125-188	1.25	18.8	50	3
UTDLX 2130-195	1.3	19.5	50	3
UTDLX 2135-203	1.35	20.3	60	3
UTDLX 2140-210	1.4	21	60	3
UTDLX 2145-218	1.45	21.8	60	3
UTDLX 2150-225	1.5	22.5	60	3
UTDLX 2155-233	1.55	23.3	60	3
UTDLX 2160-240	1.6	24	60	3
UTDLX 2165-248	1.65	24.8	60	3
UTDLX 2170-255	1.7	25.5	60	3
UTDLX 2175-263	1.75	26.3	60	3
UTDLX 2180-270	1.8	27	60	3
UTDLX 2185-278	1.85	27.8	60	3
UTDLX 2190-285	1.9	28.5	60	3
UTDLX 2195-293	1.95	29.3	60	3
UTDLX 2200-300	2	30	60	3
UTDLX 2205-308	2.05	30.8	80	3
UTDLX 2210-315	2.1	31.5	80	3
UTDLX 2215-323	2.15	32.3	80	3
UTDLX 2220-330	2.2	33	80	3
UTDLX 2225-338	2.25	33.8	80	3
UTDLX 2230-345	2.3	34.5	80	3
UTDLX 2235-353	2.35	35.3	80	3
UTDLX 2240-360	2.4	36	80	3
UTDLX 2245-368	2.45	36.8	80	3
UTDLX 2250-375	2.5	37.5	80	3
UTDLX 2255-383	2.55	38.3	80	3
UTDLX 2260-390	2.6	39	80	3
UTDLX 2265-398	2.65	39.8	80	3
UTDLX 2270-405	2.7	40.5	80	3
UTDLX 2275-413	2.75	41.3	80	3
UTDLX 2280-420	2.8	42	80	3
UTDLX 2285-428	2.85	42.8	80	3
UTDLX 2290-435	2.9	43.5	80	3
UTDLX 2295-443	2.95	44.3	80	3
UTDLX 2300-450	3	45	80	3

Milling Conditions for UTDLX

WORK MATERIAL	STRUCTUAL STEELS SS400		CARBON STEELS S50C		ALLOY STEELS SCM / SUS		ALUMINUM ALLOYS A5052	
Velocity	*Vc*=20~40 m/min		*Vc*=20~40 m/min		*Vc*=15~40 m/min		*Vc*=25~60 m/min	
Diameter (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)
0.3	20,000	50	20,000	50	16,000	40	20,000	650
0.35	19,000	60	19,000	60	13,600	50	20,000	700
0.4	18,000	80	18,000	80	11,900	50	20,000	800
0.45	17,000	100	17,000	100	10,600	60	20,000	850
0.5	16,000	120	16,000	120	9,500	60	20,000	920
0.55	15,000	140	15,000	140	9,000	70	20,000	1,050
0.6	14,100	140	14,100	140	7,900	70	19,900	1,150
0.7	12,800	140	12,800	140	6,800	70	19,900	1,230
0.8	11,900	140	11,900	140	6,000	70	19,900	1,310
0.9	10,500	140	10,500	140	6,200	70	17,600	1,350
1	9,500	150	9,500	150	6,400	70	15,900	1,400
1.5	7,200	150	7,200	150	5,500	70	12,000	1,470
2	5,600	150	5,600	150	5,000	70	9,500	1,590
2.5	4,500	150	4,500	150	4,400	70	7,600	1,640
3	4,000	150	4,000	150	3,800	70	6,400	1,700
Peck Amount	0.5D		0.3D		0.1D		0.3D	

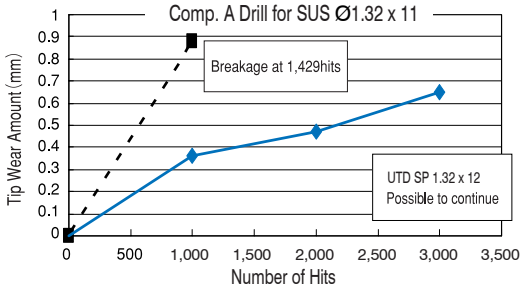
Note:
- Apply pre-drilling more than 3D depth before deep drilling. Recommend UTDSX for pre-drilling.
- Recommend shallower drilling than flute length (under Ø1:1D, Ø1 and over: 0.5D).
- Recommend water soluble or oil coolant.
- Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.



SUS420J2 (Raw Material) Comparison of UTD (Carbide) and HSS Drill Bit

UTD can drill more than 2X holes compared to an HSS model

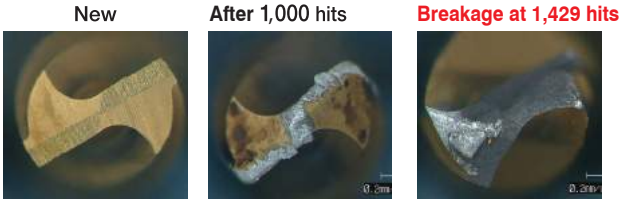
Tool Size	ϕ1.32 × 12 UTD proto type
Spindle Speed	5,000 min^{-1} (*Vc*: 21 m/min)
Feed Rate	200 mm/min (f: 0.04 mm/rev.)
Peck Amount	1.3 mm
Depth	7 mm blind hole



Flank wear comparison with HSS

UTD prototype

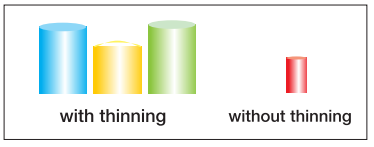
HSS Drill (Company A: Ø3 shank diameter with TiN coating for SUS)

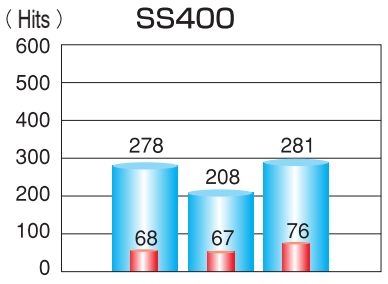


Drilling test with various material (with thinning / without thinning)

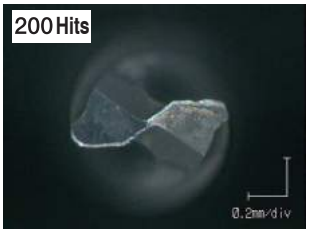
Smooth chip evacuation using the X-thinning design, offers greater resistance to breakage and more accurate drilling

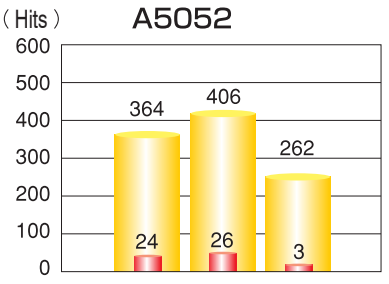
Drill Size : Ø1.0 x 15
Tool : UTDLX 2100-150 (with thinning)
Test Tool: Ø1.0 x 15 (without thinning)



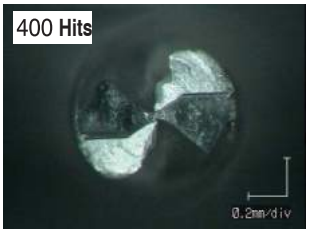


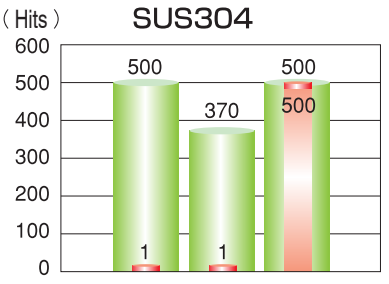
Spindle Speed	9,500 min^{-1} (*Vc*: 30 m/min)
Feed Rate	400 mm/min (f: 0.042 mm/rev.)
Step	0.2 mm
Depth	14 mm blind hole



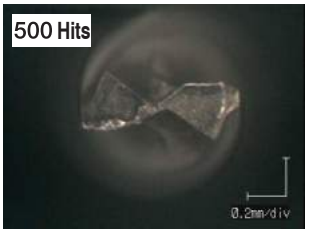


Spindle Speed	15,900 min^{-1} (*Vc*: 50 m/min)
Feed Rate	1,500 mm/min (f: 0.094 mm/rev.)
Step	0.7 mm
Depth	14 mm blind hole





Spindle Speed	6,400 min^{-1} (*Vc*: 20 m/min)
Feed Rate	150 mm/min (f: 0.023 mm/rev.)
Step	0.2 mm
Depth	14 mm blind hole



UNIMAX EURO Series

★ What is EURO Series?
The EURO series was designed for the European market and has proved very succesful with a wide range of users. It is also popular with European machine OEM's, CAM system companies and toolholder makers.

Introducing EURO Series

	Features	Coating	Flute Shape	Outside Diameter	Page
Radius/Long Neck Radius **CPRS25NSP**					
2 Flutes 	・Recommend for milling Aluminum Alloys and Plastics ・All models adopt a corner radius of R0.1 in order to prevent chipping	NON-COAT	Positive Rake Design	ø2 ~Ø 12	492
Long Neck Radius **CPRS30N**					
2 Flutes 	・Recommend for milling Aluminum Alloys and Plastics ・Designed for finishing applications	NON-COAT	Positive Rake Design	Ø 4 ~Ø 10	494
Long Neck Radius **CRS40HSP**					
3 Flutes 	・Helix angle 40˚ ・Broad application range from SUS up to Hardened Steels (60HRC)	HARDMAX	Positive Rake Design	Ø 2 ~Ø 12	496
Long Neck Radius **CRS20HSP**					
4 Flutes 	・Recommend for milling Hardened Steels and Cast Iron ・Helix angle 20˚	HARDMAX	Negative Rake Design	Ø 2 ~Ø 12	498

2 Flutes UNIMAX DRILL Short Flute

Size Ø**0.3**~Ø**2**

UTDSX

Super MG | MICRO COAT | 30° | X Thinning | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

Work Material														
STRUCTUAL STEELS SS400	Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels ~55HRC	Hardened Steels ~60HRC	Hardened Steels ~70HRC	Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
◎	◎	◎	○	Contact sales when drilling over 45HRC.			○	◎		○			○	○		

Total 35 models Unit (mm)

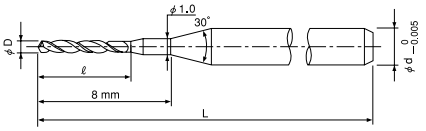
Model Number	Outside Diameter ØD	Flute Length ℓ	Overall Length L	Shank Diameter Ød
UTDSX 2030-015	0.3	1.5	38	3
UTDSX 2035-018	0.35	1.8	38	3
UTDSX 2040-020	0.4	2	38	3
UTDSX 2045-023	0.45	2.3	38	3
UTDSX 2050-025	0.5	2.5	38	3
UTDSX 2055-028	0.55	2.8	38	3
UTDSX 2060-030	0.6	3	38	3
UTDSX 2065-033	0.65	3.3	38	3
UTDSX 2070-035	0.7	3.5	38	3
UTDSX 2075-038	0.75	3.8	38	3
UTDSX 2080-040	0.8	4	38	3
UTDSX 2085-043	0.85	4.3	38	3
UTDSX 2090-045	0.9	4.5	38	3
UTDSX 2095-048	0.95	4.8	38	3
UTDSX 2100-050	1	5	38	3
UTDSX 2105-053	1.05	5.3	38	3
UTDSX 2110-055	1.1	5.5	38	3
UTDSX 2115-058	1.15	5.8	38	3
UTDSX 2120-060	1.2	6	38	3
UTDSX 2125-063	1.25	6.3	38	3
UTDSX 2130-065	1.3	6.5	38	3
UTDSX 2135-068	1.35	6.8	38	3
UTDSX 2140-070	1.4	7	38	3
UTDSX 2145-073	1.45	7.3	38	3
UTDSX 2150-075	1.5	7.5	38	3
UTDSX 2155-078	1.55	7.8	38	3
UTDSX 2160-080	1.6	8	38	3
UTDSX 2165-083	1.65	8.3	38	3
UTDSX 2170-085	1.7	8.5	38	3
UTDSX 2175-088	1.75	8.8	38	3
UTDSX 2180-090	1.8	9	38	3
UTDSX 2185-093	1.85	9.3	38	3
UTDSX 2190-095	1.9	9.5	38	3
UTDSX 2195-098	1.95	9.8	38	3
UTDSX 2200-100	2	10	38	3

Features

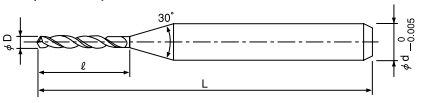
A highly efficient and economic drill for both mass and prototype production of parts.
UT MICRO COAT offers excellent performance for cutting a broad range of materials.
The new drill design and geometry offers stable drilling performance with increased tool life.
The 130˚ point angle ensures reduced burring of the drilled hole.
The drill is perfect for high quality drilling applications and for pilot drilling/pre-drilling higher aspect ratio holes.

Diameter Tolerance: Ø D0/-0.01 mm
Point Angle: 130˚

■φ0.3~φ0.65



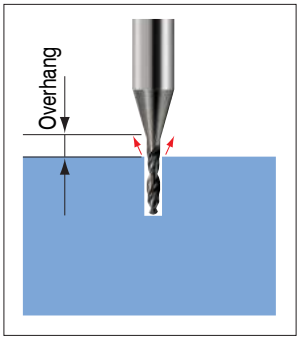
■φ0.7~φ2.0



Milling Conditions for UTDSX

WORK MATERIAL	STRUCTUAL STEELS SS400		CARBON STEELS S50C		ALLOY STEELS SCM / SUS		ALUMINUM ALLOYS A5052 / ADC12	
Velocity	*Vc*=20~35 m/min		*Vc*=20~35 m/min		*Vc*=15~20 m/min		*Vc*=20~60 m/min	
Diameter (mm)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)	Spindle Speed (min^{-1})	Feed Rate (mm/min)
0.3	20,000	100	20,000	100	16,000	80	20,000	200
0.4	17,400	130	17,400	180	12,000	90	20,000	440
0.5	15,900	150	15,900	250	9,500	100	20,000	680
0.6	14,100	170	14,100	300	8,000	110	20,000	920
0.7	12,800	180	12,800	340	6,700	110	20,000	1,160
0.8	11,900	200	11,900	380	6,300	120	20,000	1,400
0.9	10,500	200	10,500	390	6,000	130	17,500	1,430
1	9,500	200	9,500	400	6,000	150	16,000	1,500
1.5	7,300	220	7,300	500	4,500	180	13,000	1,960
2	5,600	230	5,600	560	3,000	160	9,500	2,030
Step Amount	0.3D		0.5D		0.3D		1.0D	

Note:
・Recommend shallower drilling than flute length (under Ø 1:1D, Ø 1 and over: 0.5D).
・Recommend water soluble or oil coolant.
・Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.



UNION TOOL GROUP

HEADQUARTERS
6-17-1 Minami-Ohi, Shinagawa-ku, Tokyo, JAPAN
Tel: +81-3-5493-1023

MITSUKE FACTORY
TECHNICAL CENTER
3-1 Shinko-cho, Mitsuke-shi, Niigata 954-0076,JAPAN

UNION TOOL EUROPE S.A.
Avenue des Champs-Montants 14a, CH-2074
Marin / neuchatel, SWITZERLAND
Tel: +41-32-756-6633 Fax: +41-32-756-6634

AUSTRIA
Six Sigma Tools AG
www.sixsigmatools.ch

BELGIUM
Diatool BVBA
www.diatool.be

DENMARK
VARGUS Scandinavia a/s
www.vargus.dk

FINLAND
Eltrotec OY
www.eltrotec.fi

FRANCE
A.C.R. Fabricant Outils Coupants
www.acr-affutage.fr

FRANCE
FOMM Fournitures Industrielles
fomm@orange.fr

FRANCE
OCM
www.ocm.fr

FRANCE
VSNB
vsnb@vsnb.fr

GERMANY
Schreurs-Tools GmbH
www.schreurs-tools.de

GERMANY
Six Sigma Tools GmbH
www.sixsigmatools.de

GREECE
Pantechnical
pantechnical@otenet.gr

HUNGARY
GMC PLUS BT
gmcplus@gmail.com

IRELAND
Rainford Precision Machines
www.rainfordprecision.com

ITALY
TTE s.r.l.
www.ttetec.it

MACEDONIA
Unilam Alati Dooel
precision.srb@gmail.com

NETHERLANDS
SVM-Freestechniek
www.svmfreestechniek.nl

NORWAY
Ryenstubben 5
norswiss@norswiss.no

PORTUGAL
Mafepre
www.mafepre.pt

ROMANIA
SC JAPAN TOOLS SRL
www.jtg.ro

RUSSIA
RTS Engineering Ltd.
www.rts-engineering.ru

SERBIA
Precizni Alati Doo
precision.srb@gmail.com

SLOVAKIA
CKP Chrudim a.s.
www.ckpchrudim.cz

SPAIN
Imcar
www.imcar.com

SWEDEN
Victoolia AB
www.victoolia.se

SWITZERLAND
Six Sigma Tools AG
www.sixsigmatools.ch

TURKEY
Demiral Makina A.S.
www.demiralmakina.com.tr

UNITED KINGDOM
Rainford Precision Machines Ltd.
www.rainfordprecision.com

UNION TOOL

UNION TOOL EUROPE S.A.
www.uniontool.com info@uniontool.com